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HPA-axis reactivity to interpersonal stress in young adults who self-injure.

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HPA-AXIS REACTIVITY TO INTERPERSONAL STRESS IN YOUNG ADULTS WHO SELF-INJURE

A Dissertation Presented

by

ELIZA T. MCARDLE

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DEDICATION

This dissertation is dedicated to the many patients with whom I have worked over the course of my training, who have struggled to understand their own self-injury, and to be understood by those around them. May this increase our knowledge and decrease the fear surrounding these young people who hide their wounds and pain from those by whom they most want to be understood.

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I would first and foremost like to thank my parents for 31 years of support, encouragement, and love. They raised me with the sense that I have something to share with the world, and with a value of education and learning. I hope these qualities will continue to grow from this time forward. Thank you Dad and Mom, for your unending love, guidance, and patience throughout not just my academic achievements, but my entire life.

Additionally, I would like to thank my advisor Sally Powers. Over the past four years of working together, my admiration and appreciation of your support and encouragement has never been more true than it is right now. Thank you!

ABSTRACT

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SEPTEMBER 2003

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The purpose of this study was to examine HPA-axis functioning in a non-patient sample of self-injurious adolescents in response to an interpersonal stressor. Salivary cortisol levels were measured two times prior to and five times following an interpersonal stressor as markers of HPA-axis reactivity. Women exclusively show a positive relation between self-injurious behavior and the rate at which they reach peak cortisol levels. Both trauma symptoms and depressive symptoms are shown to moderate the relations between self-injurious behavior and cortisol levels in women. Men show no association between these factors, perhaps indicating different processes behind and reasons for self-injurious behavior. These results have implications for theories of etiology, development, maintenance, and treatment of self-injurious behavior in patient populations and in the general public.

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CHAPTER 1

INTRODUCTION

Self-injurious Behavior (SIB) is a highly disturbing behavior that has been, until recently, poorly understood. Much of the current research on SIB has focused on the psychological functions and precipitants, as well as the etiological factors leading to self-injury. However, surprisingly little research has explored the physiological dysregulation that characterizes those individuals who engage in physical damage to themselves. SIB's occurrence is well documented within several populations, including individuals with severe mental retardation and autistic disorders, individuals with psychotic spectrum disorders, and people with severe personality and affective disorders (Favazza, 1996). Unfortunately it is becoming more evident that both men and women without diagnosed psychological disorders engage in SIB as well (Favazza, 1998). While the functions and meanings of self-injurious behavior are fairly well understood, very little is known about the physiological make-up, or dysregulation, in people who engage in this behavior.

In order to explore potential physiological dysregulation in SIB, it is first necessary to understand how SIB is defined in the psychological literature. Self-injurious behavior (also called self-mutilation) has been variously categorized and described by different authors over the past 15 years (Favazza, 1996; Pao, 1969, Pattison & Kahan, 1983; Walsh & Rosen, 1988). Currently, the best cited of these typologies are those by Walsh and Rosen (1988) and Favazza (1996).

Categorization of Self-Injurious Behavior

Walsh and Rosen categorize self-injurious behavior into four types, taking into consideration the degree of physical damage, the psychological state under which the behavior was performed, and the social acceptability of the behavior. Type I SIB represents the least damaging and most socially acceptable forms of behavior that are performed while the individual is in a "benign" psychological state. These behaviors include ear piercing, nail biting, and professionally applied tattoos. Type II SIB involves mild to moderate damage of the body, is acceptable in various subcultures of our society, and is performed in either a benign or agitated psychological state. Behaviors within this category include radical piercings, scarification, and large body covering tattoos. Type III SIB, the form of self-injury examined in this study, is associated with mild to moderate physical damage, is generally unacceptable within our society, and is performed in a state of psychic crisis. Behaviors such as these include wrist and body cutting or scratching, self-inflicted burns, intentional self-bruising, and intentional ingestion of poisonous substances. Finally, Type IV SIB, according to Walsh and Rosen (1988) causes severe bodily damage, is performed while in a psychotic state and is entirely unacceptable in all social groups. Behaviors that fit into this category are extremely rare even within an inpatient population and include injuries such as self-amputation, auto castration, or eye enucleation.

In another system, Favazza (1996) separates self-mutilation into two major categories, specifying sub-types within each category. He points out that SIB can be separated into either culturally sanctioned (scarification within certain religious or spiritual rituals) or pathological categories. He further separates the pathological form of

SIB into three major subtypes: Major, Stereotypic, and Moderate/superficial. Major pathological SIB, according to Favazza (1996), fits into Walsh and Rosen's "Type IV" category, while the "moderate/superficial" subtype corresponds to the Walsh and Rosen "Type III" self-mutilation. Stereotypic SIB is found mostly in mentally retarded and autistic populations and is characterized by "monotonous repetition and a rhythmic pattern" of self-injury (Favazza, 1996, p.237).

In this research, we are most interested in the "Type III" or "moderate/superficial pathological" self-mutilation because it occurs most frequently in the general population and is a troublesome and tenaciously unremitting symptom of numerous psychological disorders. Thus, this research considers SIB to be any behavior of low to moderate lethality that is considered socially unacceptable (i.e. not including tattoos and piercings) and that is performed in order to relieve increasing, intolerable psychological pain.

Self-Injurious Behavior and Corresponding Diagnoses

SIB has often been studied within inpatient and incarcerated populations, due to the fact that these subjects are easily accessible and because the amount and the severity of the self-injury is easily monitored in these groups. As a result of this sampling bias, self-injurious behavior has been recognized primarily as a symptom of Borderline Personality Disorder (BPD) or as a severe symptom of Post-Traumatic Stress Disorder (PTSD). Nonetheless, as information about this behavior has expanded, it has also been shown to be a symptom of other Axis I and Axis II disorders (Garrison, Addy, McKeown, Cuffe, & et al., 1993; Ghaziuddin, Tsai, Naylor, & Ghaziuddin, 1992; Herpertz, 1995; Winchel & Stanley, 1991; Zlotnik, Mattia, & Zimmerman, 1999). In a study by Herpertz (1995), looking at the diagnostic breakdown of 54 female psychiatric

inpatients, the diagnoses most likely associated with SIB were eating disorders (54%) (primarily Bulimia Nervosa (19%)), Psychoactive Substance and Alcohol Use Disorders (33%), and Affective Disorders (20%). In terms of Personality Disorders, Herpertz (1995) found that of 54 psychiatric inpatients with SIB, more than half were likely to be diagnosed with BPD (52%) and almost a quarter were diagnosed with Histrionic Personality Disorder (23%).

Garrison et al (1993) published a study examining the prevalence and correlates of SIB in a non-patient population of adolescents (aged 12-14). They found that SIB was most commonly associated with a concurrent diagnosis of Major Depressive Disorder (MDD). Simeon, Stanley, Frances and Mann (1992) and Ghaziuddin et al. (1992) similarly found that the two most common diagnoses in inpatient adult and adolescent (respectively) self-injurers were MDD and BPD.

In the general population, the incidence of SIB has been estimated to be anywhere from .75% (Favazza & Conterio, 1989) to 2.5% (Garrison et al., 1993) to 4% (Briere & Gil, 1998). Even more shocking, in the college population, authors have found the incidence of SIB to be 12% (Favazza, DeRosear, & Conterio, 1989) and 16% (Rulf Fountain, 2001).

Description and Function of Self-Injury

As was described above, self-injury can occur as a symptom of many different psychological disorders, and similarly, self-injury may happen as the result of many types of external (or internal) stressors. Literature on the reasons for and functions of self-injury is extensive. While often thought of, by the layperson, as a form of manipulation and attention seeking, current research has demonstrated that the underlying stressors

leading to a particular act of SIB are often related to interpersonal conflict or the threat of interpersonal loss or abandonment. To an individual who is especially sensitive to interpersonal conflict, a stressor of this type can result in rapidly rising negative affect, which is then exacerbated by inadequate coping skills, potentially leading to an act of self-injury (Briere & Gil, 1998; Collins, 1996; Darche, 1990; Kemperman, Russ, & Shearin, 1997; Pao, 1969; Raine, 1982; Suyemoto, 1998).

> Self-mutilation may be used to express emotion and conflict both to the self and to others, as well as to achieve a sense of control over emotion that threatens to generally overwhelm the individual, her sense of self, and her connectedness to the world.
>
> (Suyemoto, 1998, p. 542)

Regardless of the psychological syndrome or the initial stressor, the affective experience leading up to an act of self-injury can be remarkably similar across diagnostic category and in the general population. Herpertz, (1995) provides a concise description of the typical affective experience of an individual who self-injures. Prior to an act of self-injury, individuals report experiencing internal agitation, anxiety, rage, or despair. As the tension increases, the individual may begin to feel a sense of emptiness and isolation followed by an inability to verbalize or to tolerate the extreme feelings. The act of self-injury is often an impulsive act and has the effect of releasing the tension quickly. With repeated use, SIB can become a coping mechanism for dealing with many levels of interpersonal stressors, and unfortunately it works quite effectively both physiologically (Brain, Haines, & Williams, 1998; Haines, Williams, Brain, & Wilson, 1995) and psychologically (Favazza, 1996; Herpertz, 1995; Simeon, Stanley, Frances, Mann, & et al., 1992; Suyemoto, 1998; Turp, 1999; Walsh & Rosen, 1988) to temporarily reduce seemingly unbearable distress.

While it is heartening that we are beginning to have a comprehensive understanding of the etiology, functions, and results of self-injurious behavior, we still have a very limited understanding of how or why this form of coping actually works. Current researchers have very little understanding of whether there is some form of dysregulation within a self-injuring individual's stress response system that might differentiate them from similarly distressed individuals who do not engage in self-injury. To explore this possibility, we must first understand how the physiological stress management system can be dysregulated in individuals with other forms of psychopathology.

Healthy Stress Reactivity

While a comprehensive review of the human body's response to stress is beyond the scope of this paper, an understanding of how the hypothalamus-pituitary-adrenal (HPA) axis system, and cortisol levels in particular, react to stressful events is imperative. The HPA-axis functions primarily to help an individual mobilize energy to deal with external stressors (van der Kolk, McFarlane, & Weisaeth, 1996). Cortisol is one of the major hormonal products created and utilized by the HPA system and is recognized as an indicator of HPA-axis functioning (Stansbury & Gunnar, 1994).

With the onset of an actual or perceived stressor, the human brain begins secreting hormones in order to facilitate physiological arousal, alertness, vigilance, and appropriate aggression (Chrousos & Gold, 1992). The hormonal stress response begins in the hypothalamus, which releases corticotropin-releasing-hormone (CRH), which itself acts upon the cells of the anterior pituitary gland. The anterior pituitary begins secreting adrenocorticotrophic hormone (ACTH), stimulating cells in the cortex and the adrenal

glands to produce and release cortisol into the general circulation (Stansbury & Gunnar, 1994).

Following the perception of a stressor, the HPA-axis initiates the above process in a matter of milliseconds, nonetheless it can take anywhere from 10-15 minutes to produce a measurable rise in circulating cortisol levels, and from 20-30 minutes to reach its peak concentration (Stansbury & Gunnar, 1994).

Dysregulation of the HPA-axis and Psychiatric Disorders: PTSD

There are several prominent researchers in the field of HPA-axis functioning who have begun exploring stress reactivity in people with Post Traumatic Stress Disorder (PTSD). The work of Blanchard, Kolb, Pallmeyer, and Gerardi (1982), Blanchard, Kolb, Gerardi, and Ryan (1986), and Pitman, Orr, Forgue, de Jong, and Claiborn (1987) began the exploration of physiological responsivity of post-war veterans diagnosed with PTSD. They demonstrated that PTSD patients were physiologically much more responsive (increased heart rate, skin conductance, and EKG) than control subjects in response to an imagined combat script (Blanchard, Kolb, Gerardi, Ryan, & et al., 1986; Blanchard, Kolb, Pallmeyer, & Gerardi, 1982; Pitman, Orr, Forgue, de Jong, & et al., 1987). Interestingly, Pitman et al (1987) also found that the PTSD subject's physiological responses (measured as a change score from basal levels) to the neutral, non-stressful script were smaller than the responses of control subjects. This highlighted the point that these PTSD subjects were not simply *more responsive to all stressors*, but were highly reactive to specific stimuli.

Taking this work a bit farther, Yehuda, Southwick, Nussbaum, and Wahby (1990) and Yehuda, Resnick, Kahana, and Giller (1993) published consolidating and clarifying

studies on HPA-axis functioning in PTSD patients. They found that PTSD patients showed lower mean 24-hour urinary cortisol excretion (1990) and that they similarly were shown to have more effective HPA feedback inhibition (1993). For example, subjects who had undergone repeated traumas, such as multiple rapes, were found to have faster cortisol recovery (as measured by return to basal score), than those who were experieneing their first traumatie ineident (Yehuda, Teicher, Trestman, Levengood, & Siever, 1996). This seems to indicate that PTSD patients have a highly reactive (they will respond strongly to novel stressors), yet more sensitive (the HPA negative feedback system goes quickly into action) HPA axes than normal control subjects. Van der Kolk (1996) explains this by stating that people with PTSD have adapted to chronic extreme stress by hyper-tuning the stress response system, leading to decreased overall resting levels of cortisol in the body, as well as a decreased level of cortisol secretion in response to subsequent stressors that resemble the original stressor.

Interestingly, Yehuda, Southwick, Nussbaum and Wahby (1990) have also shown that in response to a novel or an extreme stressor, subjects with PTSD may show a normal or slightly inereased stress response (eompared to non-psychiatric participants). But because of the HPA-axis hypersensitivity, their bodies will return to its physiological resting state more quickly (Yehuda, Boisoneau, Mason, & Giller, 1993; Yehuda, Resniek, Kahana, & Giller, 1993; Yehuda, Southwick, Nussbaum, Wahby, & et al., 1990).

Dysregulation of the HPA-axis and Psychiatric Disorders: MDD

In comparison to individuals with PTSD as well as healthy controls, depressed patients have been shown to have a quite different pattern of HPA reactivity. Stokes and Sikes (1987) and Gold, Goodwin, and Chrousos (1988) showed that patients with MDD

tend to have higher plasma and urinary levels of cortisol than non-depressed individuals. Expanding this finding, Yehuda, Teicher, Trestman, Levengood and Siever (1996) monitored cortisol levels in both PTSD and MDD patients over a 24-hour period. This research group found that while the MDD patients did not tend to have higher levels of cortisol secretion throughout the day, they showed a significantly more dysregulated and chaotic pattern of secretion than either the PTSD patients or the non-disordered patients. This does not discredit the previous findings of hypercortisolism in MDD patients, but instead helps to explain the finding, as previously hypercortisolism could only be documented in 50% of the MDD cases studied (Gold, Goodwin, & Chrousos, 1988; Stokes & Sikes, 1987). These patients, according to Yehuda's findings, tend to have increased cortisol secretion under stress, and then have a more difficult time returning to baseline following a stressor, periodically leading to an overall higher level of cortisol throughout the body over the course of a day.

Physiological Reactivity in Self-Injurious Behavior

Because the models of HPA-axis reactivity in MDD and PTSD patients are quite different, it is difficult to predict the HPA-axis functioning of people who engage in SIB. We are left to wonder whether the stress response system of people who engage in (or who have engaged in) self-injury is functioning differently than or similarly to the PTSD patient, the MDD patient, or the non-disordered subject.

Previous research looking at cortisol reactivity in self-injurers has been inconclusive (Rulf Fountain, 2001) finding no differences in the baseline levels of cortisol between self-injurers and control participants. Similarly, Rulf Fountain (2001) found no reactivity differences between self-injurers and control subjects when subjected

to a mathematical and public speaking stressor. Nonetheless, for individuals who self-injure, specific stressors may be more taxing than others, leading us to question whether an interpersonal stressor might create more of a stress reaction for these participants.

The literature suggests that self-injury is often a coping method for dealing with interpersonal stress. Poor communication skills, lack of connection to others, and ambivalence about becoming attached to another person are characteristics that have been associated with self-injurious behavior (Bennun, 1984; Collins, 1996; Favazza & Conterio, 1989; Suyemoto, 1998; Tulloch, Blizzard, & Pinkus, 1997). These personality and skill deficits often lead to difficulties in interpersonal relationships as well increased distress within interpersonal conflicts (Collins, 1996; Kemperman et al., 1997; Tulloch et al., 1997). The current study uses a pre-existing, ongoing conflict with each individual's romantic partner as the source of stress, rather than the circumscribed, non-interpersonal task that Rulf Fountain (2001) used, with the hopes that this type of task will be more likely to produce significant HPA-axis activity.

The Present Study

Because people who engage in SIB feel the impulse to cause their body physical trauma, it seems likely that their physiological processing of stress and trauma may be different than those who handle stress in a more adaptive way. Complicating the matter is the fact that self-injury is not considered a disorder, but rather a feature of numerous psychological disorders such as Post Traumatic Stress Disorder, and Major Depressive Disorder. As described above, these disorders have both been shown to have different stress reactivity profiles. The current study explores how people who engage in SIB experience stress, with the ultimate goal of understanding how symptoms of PTSD and

MDD may contribute to SIB patterns of stress reactivity. Thus, this study is driven by five main research inquiries.

Questions

1) How is SIB related to current trauma or depressive symptoms?
2) Is the current interpersonal stressor creating an HPA-axis response measurable by salivary cortisol?
3) Is there a relation between the basal cortisol score, anticipatory score, reactivity, time of peak, and extent of recovery of stress-induced cortisol reactivity and SIB?
4) Does the relation between SIB and HPA-axis reactivity change when taking into consideration depressive symptoms, trauma symptoms?
5) Do depression and trauma symptoms moderate the relation between SIB and HPA-axis reactivity?

CHAPTER 2

METHOD

Participants

Participants for the study are 170 older adolescents (aged 18-21) who are part of a larger study exploring a biopsychosocial model of adolescent depression. The larger study is conducted in three sessions taking place over the course of six months. All information in the current study was collected during the first session. Recruitment for the study was completed in the five-college community of the Pioneer Valley as well as surrounding non-college community members. Late adolescence was chosen as the developmental period in this project for three reasons: a) current research on SIB has shown high levels of self-injurious behavior among college-aged adolescents (Alexander, 1999; Rulf Fountain, 2001); b) HPA reactivity and behavioral coping has focused on infancy through middle adolescence and has not examined late adolescence; c) and finally, because this is a time period during which romantic relationships are of increased importance, the use of an interpersonal stressor will likely be quite effective in creating a physiological response (Kirschbaum & Hellhammer, 1989).

The final sample for this project consisted of 85 (50%) males and 85 (50%) females. Ages ranged from 18 to 21 years old with a mean age of 19.3 years old (SD=0.87). The sample came from a fairly well distributed range of socioeconomic class backgrounds, as measured by parental education levels. Forty (23.5%) mothers have completed a graduate degree, 6 (3.5%) have completed some graduate school, 49 (28.8%) have completed a college degree, 32 (18.8%) have completed some college, and 42

(24.7%) completed either high school or some form of trade school. Fifty-two (30.6%) fathers have completed a graduate degree, 3 (1.8%) have completed some graduate school, 53 (31.2%) have completed a college degree, 24 (14.1%) have completed some college, and 34 (20.0%) completed either high school or some form of trade school.

In order to compare the ethnic make-up of our sample to current census data, we obtained statistics from the Massachusetts Institute for Social and Economic Research regarding the demographics for youth in our community. From these statistics, we were able to document a profile of youth in this community in the target ages. This population is 6.1% Asian-American or Native American, 3.3% African-American, 3.9% Latino or Hispanic, and 86.7% European-American. The community population is highly similar to our participants, although our participants have a slightly higher proportion of ethnic minorities. In the current sample, 9 (5.3%) individuals report Asian or Asian-American heritage, 1 (0.6%) is Native American, 2 (1.2%) are African-American, 12 (7.1%) are Latino or Hispanic, and 137 (80.6%) are of European-American decent. Eight (4.7%) participants claim "Other" racial background and 1 participant failed to report his ethnic background.

Recruitment

Recruitment for the current study was done through posters, sign-up sheets via psychology classes, and word of mouth. Participants in the current study are recruited based on three primary factors: 1) they are between the ages of 18 and 21; 2) they are currently in romantic relationships which have been ongoing for at least 2 months; 3) and their partners must also be between the ages of 18 and 21. Individuals in both same sex and opposite sex romantic relationships are welcome to participate.

No over-sampling of individuals who have engaged in self-injury was necessary in order to boost the SIB sample. Initial data analysis and previous studies using this population have shown that the prevalence of SIB is quite high, which was confirmed by our exclusive use of subjects recruited only on the basis of their age and relationship status.

Each participant was paid $20 for their participation in the initial 3-hour session, $20 for the 2nd session and $40 for the 3rd session. Additionally, participants who were in introductory psychology classes at the University of Massachusetts had the option to receive six psychology research credits toward their final grade in the course.

Procedure

During an initial telephone-screening interview, participants are informed that they are invited into the lab with their romantic partners to participate in a study about conflict negotiation between romantic partners and about individuals' physiological reactions when involved in discussions with their partners. They are additionally told to refrain from drinking alcohol, using illegal drugs, or visiting the dentist within the 24 hours prior to the study. They are asked not to exercise, eat, drink (except water), smoke cigarettes, or brush their teeth up to 2 hours prior to the study because any contaminants in their saliva may alter the accuracy of the cortisol measurements.

When adolescents arrive at the laboratory they are welcomed and given a review of the purpose and procedures of the project. They are told that the purpose of the study is to learn more about how romantic partners communicate with each other and about individuals' physiological reactions when involved in discussions with their partners. Participants are seated in one room at individual tables with computers, separated by a

cloth room divider. The divider ensures that participants cannot see each other's responses to computerized questionnaires and discourages talking about answers.

Participants are given the informed consent form to read and sign (Appendix A). Each participant is then given a thermometer with removable sanitary cap that assesses temperature by placement under the tongue. Participants' temperatures are assessed to ensure that participants are not acutely ill, as this may affect HPA functioning. If participants have an elevated temperature or feel ill; report that they have had alcohol, used illegal drugs or had any mouth or gum abrasion in the past 24 hours; or report that they have brushed their teeth, eaten, drunk caffeinated beverages or exercised in the past two hours, they are scheduled to return at a later date.

Next, participants fill out an Admission Questionnaire (Appendix B) that contains information about variables that potentially affect HPA functioning, such as the number of hours of sleep the previous night, daily medications or vitamins, the use of oral contraceptives, phase of menstrual cycle, and the possibility of pregnancy, as these topics may be subject to statistical control at the time of data analysis. When the admissions form is completed, participants give the first salivary cortisol sample (a baseline sample). Couples are then given a detailed description of the conflict task and fill out a form that asks them each to name a recent source of disagreement. Participants separately choose a conflict topic with the understanding that they will be asked to discuss one of the topics during the conflict task. Ten minutes following the detailed description of the task, participants give a second salivary cortisol sample that serves as a pre-task measure of anticipatory anxiety. Anticipatory anxiety will be measured in order to differentiate

between physiological reactivity to the imagined interaction, and reactivity that is more likely to be associated with the conflict task.

Meanwhile, a research assistant chooses one of the issues (using a coin toss) that will serve as the topic of discussion and writes it on an index card. The couple is then brought to another room in the laboratory equipped with three wall-mounted digital video cameras and a couch. The couple is asked to sit on the couch and the cameras are turned on. The note card is placed on the floor in front of the couple and the research assistant says, "On this card is an issue which has come up between the two of you in the past. I have tossed a coin and chosen one of the topics that one of you stated has been a source of disagreement. We would like you to spend 15 minutes discussing this issue. We are interested in how couples normally discuss their differences, although we want you to know that we recognize that being videotaped is different than being at home in private. Please discuss this issue presenting your point of view, and try to come to a resolution of the issue. The goal of this task is to attempt to resolve the conflict. We will end the discussion in 15 minutes by knocking on the door. While you have this discussion, I will be in the next room and will be unable to hear your discussion. Do you have any questions before we begin?"

After completion of the conflict negotiation task, couples are taken back to the first room and seated again at their tables, separated by the room divider, to fill out a questionnaire packet. Participants provide five additional saliva samples during the time that they complete the questionnaire packet. Saliva samples are collected at 10, 20, 30, 45, and 60 minutes post-task.

There is no deception involved in this study. Individuals are informed at the end of the 3rd session that the primary focus of the study is an exploration of a biopsycho-social model of adolescent romantic relationship conflict negotiation (Appendix C).

Saliva Collection Procedures and Considerations

Because cortisol levels follow a circadian rhythm, participants are invited into the lab at 4pm, the time period in the day during which cortisol levels are the most stable (Kirschbaum & Hellhammer, 1989). Keeping daily cortisol levels as stable as possible decreases the amount of noise in our cortisol data, and additionally increases the possibility that any shifts in cortisol due to the interpersonal stressor will appear in the data.

Saliva is collected from each participant seven times throughout the session, following the procedures set forth by Salimetrics, LLC, the lab that we have contracted to analyze and calculate all cortisol levels. Following their advice, participants are instructed to use a "passive drool method" to collect the saliva samples. Grocery store variety plastic straws are cut into three or four sections. Participants are handed a section of a straw as well as a small plastic vial (also of the sort recommended by Salimetrics). The participants are instructed to "passively drool down the straw and into the vial" with their heads tilted forward until the required amount of saliva is collected. The vial is then tightly sealed and immediately placed in frozen storage (-20 degrees C) until it is shipped to Salimetrics (on dry ice) for analysis of cortisol levels. This collection procedure is explained to the participants and repeated at each separate saliva collection time point.

Salimetrics, LLC's specific laboratory procedures for determining cortisol levels can be found in Appendix D.

Measures

Informed Consent

A consent form providing a thorough explanation of the study procedures as well disclosure of any risks or benefits of participating in the study is provided to each participant. An explanation of anonymity, confidentiality, and the withdrawal procedure is explained on this form. Participants are made aware that all information is kept confidential except in the case of disclosure of suicidal intent, homicidal intent, or child or elder abuse. Additionally, participants are informed that they are free to withdraw at any time point without penalty. (Appendix A)

Physical Health Questionnaire

Participants are asked about current health status, daily medications, and recent use of illegal drugs or alcohol, recent food intake, exercise, tooth brushing, dental work, and the number of hours slept in the past 24 hours. Female participants are asked about their use of oral contraceptives, pregnancy, and date of last menstruation. (Appendix B)

Demographics

Demographic questions include information about the participant's age, race, gender, and socio-economic status. (Appendix E)

Center for Epidemiological Studies Depression Scale (CES-D)

The CES-D (Radloff, 1977) is a 20-item questionnaire that measures depression symptoms in community samples of adults. Similarly, the scale has been used to reliably assess adolescent depressive symptoms (alpha > 0.87) (Radloff, 1991; Roberts, Andrews, Lewinsohn, & Hops, 1990). The scale is scored as a sum of the frequency of occurrence of 20 symptoms. In the present sample of late adolescents, Chronbach's alpha proved to be similarly reliable (n=170, alpha = 0.82). (Appendix F)

Trauma Symptom Checklist (TSC-40)

The TSC-40 (Briere & Runtz, 1989) is a 40-item, self-report measure that assesses the prevalence of symptoms that are likely to have arisen from adult or childhood trauma experiences. The checklist consists of 6 subscales including: Anxiety, Depression, Dissociation, Sexual Abuse Trauma Index, Sexual Problems and Sleep Disturbance. A total scale score can be calculated and has been found to be more reliable than any of the subscales (alpha between .89 and .91) (Briere & Runtz, 1989). Only the total scale score will be used in the current study. In the present sample of late adolescents, Chronbach's alpha for the total scale score proved to be similarly reliable (n=170, alpha = 0.86). (Appendix G)

In the current study, the TSC-40 and the CES-D are highly correlated ($r(170) = 0.48$, $p<0.001$), although their overlap accounts for only 25% of the variance in scores. We have therefore decided that the scales are measuring different phenomena.

Self-Injurious Behavior Questionnaire (SIB-Q)

A measure assessing the occurrence of self-injurious behavior was constructed for this study from self-injury literature and from several pre-existing measures (Alexander,

1999; Rulf Fountain, 2001). The questionnaire asks the participant about any instances of self-inflicted injury that would fall into the "Type III" category of SIB. Participants are asked how many times they have engaged in each of 9 behaviors including: ever self-harmful, self-bruising, self-hitting, hair-pulling, self-scratching, self-biting, self-poisoning, self-burning, and self-cutting. The questionnaire also assesses the recency of each type of self-injurious behavior that the participant acknowledges having used. The exact wording assessing each behavior can be found in Appendix H.

Self-injury scores were calculated in four ways. Initially, following the methodology of Rulf-Fountain (2001) a weighted-continuous measure of SIB, titled "SIB-weighted" was calculated in a manner that took into consideration the severity of the form of the behavior as well as the frequency and the recency of the act. The methodology for calculating the "SIB-weighted" score follows. Mild self-mutilative behavior (including "ever harmful," "self-bruising," "self-hitting," and "hair-pulling") was given a weighted score of 1. Moderately damaging self-mutilative behavior (including "self-scratch" and "self-bite") was given a weighted score of 5. The more severe forms of self-injury (including "self-poison", "self-burn", and "self-cut") were given a weighted score of 10. Next, the sum of the occurrence of each weighted behavior was multiplied by the frequency (which is a score between zero and five). For example, if a participant reported having cut herself "between 6-10 times" (severity of 10 and frequency of 3) and having bitten herself "between 2-5 times" (severity of 5 and frequency of 2), the weighted score would be (3*10) + (2*5) = 40 (i.e. $frequency_1*severity_1 + frequency_2*severity_2 + frequency_3*severity_3\ldots$).

The final step in calculating the "SIB-weighted" score is to take the recency of the behavior into account. The scores calculated above were multiplied by either 1 or by 10. Scores of the participants who had engaged in the behavior within the past 6 months, were multiplied by 10. While scores of those who had not engaged in the behavior within the past 6 months, were multiplied by 1. So, continuing with the above example, if the participant reported that she had last engaged in one of the behaviors within the past month, her "SIB-weighted" score would be calculated as: 10 [(3*10) + (2*5)] = 400.

Additionally, 3 more stringent and specific measures of SIB were calculated. The first, titled "SIB-severity", is a score indicating whether a participant has engaged in any of the more severe forms of self-injury (self-scratching, self-biting, self-poisoning, self-burning, or self-cutting) two or more times, at any point in their lives. The second self-injury scale, titled "SIB-frequency", is a continuous measure of the maximum frequency of any form of severe self-injury. The score ranges from 0 to 5, with a score of 0 representing never having engaged in any of the severe forms of self-injury. A score of 1 represents only a single occurrence of any of the forms of severe self-injury. A score of 2 indicates that the individual engaged in at least one of the forms of behaviors between 2-5 times. A score of 3 represents 6-10 times. Four represents 11-20 times and a score of 5 represents engaging in at least one of the behaviors over 20 times.

The final measure of self-injurious behavior, titled "SIB-recency" takes into account only the recency of the self-injury; but once again is only assessing the more severe forms of self-injury (self-scratching, self-biting, self-poisoning, self-burning, or self-cutting). This score is a continuous measure of the how recently the individual engaged in any of the more severe forms of self-injury. The score ranges from 0 to 6,

with a score of 0 representing never having engaged in any of the severe forms of self-injury. A score of 1 represents having engaged in the behavior over 5 years ago. A score of 2 indicates that the individual engaged in at least one of the forms of behaviors between 1 to 5 years ago. A score of 3 represents the fact that the behavior occurred within the past year. Four represents the past 6 months; a score of 5 represents engaging in at least one of the behaviors in the past month, and 6 indicates that it occurred within the past week.

Cortisol Measurements

Cortisol levels and reactivity were evaluated using 10 different variables. The first seven variables are simply the level of salivary cortisol measured for each individual at each of the seven time points. The first measurement is considered the basal level, the second is the anticipatory level, and as mentioned above, the third through seventh measurements represent reactivity to the assigned task at 10, 20, 30, 45, and 60 minutes post task. The final three cortisol variables are calculations which represent the cortisol profile of each individual. The first variable is a measure of HPA-axis reactivity, as represented by the basal cortisol level subtracted from the maximum cortisol level. In accordance with numerous researchers (Granger, Stansbury, & Henker, 1994; Yehuda, Resnick et al., 1993) this is often chosen as a marker of HPA-axis functioning, with higher scores indicating increased stress reactivity in response to a stressor. The second variable represents how quickly each individual reached their maximum cortisol level and is simply the time point in minutes at which that occurred. Following (Yehuda, Boisoneau et al., 1993; Yehuda, Resnick et al., 1993; Yehuda et al., 1990) findings that individuals with PTSD show more "fine-tuned" HPA-axis responses to stress, this

variable will allow us to measure how quickly participants' HPA-axes respond to the anticipation of or the actual occurrence of the interpersonal stressor. The final cortisol measurement is a calculation of the extent of cortisol recovery at the end of the study, represented by the final cortisol level subtracted from the basal score. Again, based on previous literature which suggests a difference in the ability of traumatized individuals and depressed to return to their basal cortisol levels (Yehuda et al., 1996) this variable will allow us to assess the relations between the extent of recovery and our measures of psychopathology.

CHAPTER 3

RESULTS

Results are presented in 6 sections that directly follow the research questions. All data was analyzed separately for men and women due to the fact that their data is not independent.

Preliminary Analyses

Means, standard deviations and frequencies of cortisol levels, trauma symptoms (TSC-40), depressive symptoms (CES-D), and self-injury scores are shown in Tables 1 and 2. Statistically significant sex differences in the psychopathology variables were found only for trauma symptomatology. Women in our sample had higher levels of trauma symptoms than men. No gender differences were found in levels of depressive symptoms or in any of the measures of self-injury (see Table 1).

Among the cortisol variables, men had higher levels of salivary cortisol at the 2nd collection time, which represents the anticipatory measurement point in the paradigm. There were no sex differences in any of the other six collection points. Interestingly, while there were no sex differences in cortisol reactivity or in the time-to-peak variable, men showed significantly more recovery in their reactivity than did the women (see Table 2). Tables 3 and 4 show the frequencies of the recentness and of the types of self-injurious behavior for men and women.

Question 1: How is SIB related to current trauma or depressive symptoms?

In order to assess the ways in which SIB is related to current trauma or depressive symptoms, correlations of the CES-D, the TSC-40, and the SIB variables were

completed. None of the self-injury variables correlated significantly with depression or trauma symptoms for the men, but there were many significant correlations for the women (see Table 5). Each of the four women's self-injury variables is correlated with trauma symptoms in the expected direction. Only the SIB-weighted score fails to be significantly correlated with depressive symptoms, while each of the three variables looking at more severe self-injury (SIB-frequency, SIB recency, and SIB severity) is significantly correlated with depressive symptoms.

Question 2: Is our stressor creating a measurable HPA-axis response?

In order to assess whether our stressor is creating a measurable HPA-axis response, paired T-tests were used to compare the maximum level of cortisol with the basal cortisol levels. Cortisol levels for both men and women were significantly higher at their maximum level than at their basal level (see Table 6). A graph of the mean cortisol profiles for both men and women demonstrates this elevation and subsequent decline (See Figure 1).

Question 3: Is there a relation between SIB and Cortisol Variables?

All regressions include variables controlling for alcohol use within the past 24 hours, use of Selective Serotonin Reuptake Inhibitors (SSRIs), as well as use of allergy medications as each of these were significantly correlated with several cortisol levels and cortisol reactivity. No other daily medications or physiological variables were significantly correlated with cortisol levels at any time point used in further analysis or with the profile variables (See Tables 7 & 8). Only men reported using alcohol in the 24 hours before the study (N=6), and only women reported using SSRIs (N=1), hence these variables were only included in the appropriate sex-specific regression equations.

Multiple regression analyses were used to examine whether self-injurious behavior is related to HPA-axis activity in response to the interpersonal stressor and are represented by the following equations:

1) 10 Cortisol variables W Allergy meds (AM) + Alcohol (Alc) + SSRIs + SIB (weighted)
2) 10 Cortisol variables W AM + Alc + SSRIs + SIB (severity)
3) 10 Cortisol variables W AM + Alc + SSRIs + SIB (frequency)
4) 10 Cortisol variables W AM + Alc + SSRIs + SIB (recency)

The SIB recency variable for women predicted the time at which the participant reached her peak cortisol level. As expected, for women, the more recently they had engaged in self-injury, the more quickly they reached their peak cortisol reaction to interpersonal conflict (see Table 9). No other direct relations were found between self-injury and cortisol levels in either men or women.

Question 4: Does the relation between SIB and HPA-axis reactivity change when taking into consideration depressive symptoms, trauma symptoms?

In order to assess the importance of depression and trauma symptoms to the cortisol profile, and to assess whether these variables would better account for the previous finding, the following simultaneous multiple regressions were performed.

1) 10 Cortisol variables W AM + Alc + SSRIs + SIB (weighted) + CES-D + TSC-40
2) 10 Cortisol variables W AM + Alc + SSRIs + SIB (severity) + CES-D + TSC-40
3) 10 Cortisol variables W AM + Alc + SSRIs + SIB (frequency) + CES-D + TSC-40
4) 10 Cortisol variables W AM + Alc + SSRIs + SIB (recency) + CES-D + TSC-40

Controlling for current depressive and trauma symptoms weakened the relation between SIB recency and the time of peak cortisol levels, leaving only a trend toward significance (See Table 10). No further significant relations were found while exploring these equations.

Question 5: Do depression and trauma symptoms moderate the relation between SIB and HPA-axis reactivity?

The following simultaneous multiple regressions were performed in order to assess whether trauma symptoms or depression symptoms play a moderating role in the relation between self-injurious behavior and HPA-axis functioning. Variables in interaction terms were centered to reduce multicolinearity.

1) 10 Cortisol variables WAM + Alc + SSRIs + SIB weighted + CES-D + CES-D*SIB weighted
2) 10 Cortisol variables W AM + Alc + SSRIs + SIB severity+ CES-D + CES-D*SIB severity
3) 10 Cortisol variables W AM + Alc + SSRIs + SIB frequency + CES-D + CES-D*SIB frequency
4) 10 Cortisol variables W AM + Alc + SSRIs + SIB recency + CES-D + CES-D*SIB recency
5) 10 Cortisol variables W AM + Alc + SSRIs + SIB weighted + TSC-40 + TSC-40*SIB weighted
6) 10 Cortisol variables W AM + Alc + SSRIs + SIB severity+ TSC-40 + TSC-40*SIB severity
7) 10 Cortisol variables W AM + Alc + SSRIs + SIB frequency + TSC-40 + TSC-40*SIB frequency
8) 10 Cortisol variables W AM + Alc + SSRIs + SIB recency + TSC-40 + TSC-40*SIB recency

Several interesting relations emerged exclusively for the women. In women, trauma symptomatology was found to moderate the relation between the level of anticipatory cortisol and the SIB weighted score (see Table 11 and Figure 2), indicating that at higher levels of trauma symptomatology, SIB and anticipatory cortisol levels were positively related. Similarly, trauma symptomatology was found to moderate the relation between the amount of time to peak cortisol levels and the SIB weighted score (see Table 12 and Figure 3). This interaction indicates that at higher levels of trauma symptomatology, as women's SIB scores increase, the amount of time to reach peak cortisol levels decreases.

Depressive symptoms, on the other hand, were found to moderate the relation between basal cortisol levels and the SIB weighted score (see Table 13 and Figure 4), as

well as the relation between anticipatory cortisol levels and the SIB weighted score (see Table 14 and Figure 5). These interactions both indicate that at higher levels of depression, women's SIB scores are positively related to basal and anticipatory cortisol levels.

CHAPTER 4

DISCUSSION

The aim of this study was to examine HPA-axis functioning in response to an interpersonal stressor in a non-clinical sample of individuals with varying levels of self-injurious behavior. Salivary cortisol levels were measured two times prior to and five times following the interpersonal stressor in order to obtain markers of cortisol reactivity as a marker of HPA-axis functioning. Previous research has theorized, based purely on self-report through clinical case studies and qualitative reports, that an act of SIB is likely to occur in response to perceived threats of interpersonal loss or abandonment (Briere & Gil, 1998; Collins, 1996; Darche, 1990; Kemperman et al., 1997; Pao, 1969; Raine, 1982; Suyemoto, 1998). The current study strengthens this association by demonstrating that self-injury is related to interpersonal stress on a physiological level, and that the relation between self-injury and interpersonal stress is different for men and women. Additionally, the present study shows that the relation between self-injury and interpersonal stress reactivity is moderated by depression and trauma symptoms in ways that are supportive of previous literature on HPA-axis reactivity. Finally, the current study used a sample of college-aged participants from the general population, demonstrating that this phenomenon is occurring and is measurable even in sub-clinical populations. As a result, these findings have implications for theories of etiology, development, maintenance, and treatment of self-injurious behavior not just in patient populations, but also in the general public.

In prior studies looking at HPA-axis reactivity to an induced stressor, clear indications of HPA-axis reactivity have been inconsistent. Lack of reactivity has been explained as being related to timing in the circadian rhythm of cortisol (Klimes-Dougan et al., 2001) or to the type of stressor used (Rulf Fountain, 2001). By taking each of these factors into account, through measuring salivary cortisol at a time of day when the daily levels are thought to be most stable, and by using a personally relevant stressor, we were able to show a clear relation between basal cortisol levels and a subsequent increase either in anticipation of or in reaction to engaging in the induced stressor.

Additionally, the current study is ground breaking in that little research has been done looking at physiological stress reactivity in self-injurers (Brain et al., 1998; Haines et al., 1995), and only one unpublished study has looked at stress induced cortisol reactivity in these individuals (Rulf Fountain, 2001). Rulf-Fountain's (2001) study assessing cortisol reactivity and self-injurious behavior was unable to find any direct relation between the two variables. In the current study, by assessing the recency of severe types of self-injury, a relation was found that indicated that for women, the more recently they had engaged in one or more severe forms of SIB, the more quickly they react to the interpersonal stressor and reach peak levels of cortisol. These women react physiologically to a conflict with their romantic partner quite rapidly, and sometimes in anticipation of the task. It seems they are swiftly preparing themselves against a threat. This coincides with literature which suggests that self-injurers often perceive interpersonal conflict as a precursor to abandonment and intolerable pain (Briere & Gil, 1998; Collins, 1996; Darche, 1990; Kemperman et al., 1997; Pao, 1969; Raine, 1982; Suycmoto, 1998). These women may be preparing themselves for a major threat to the

ego which has been shown to be associated with increased cortisol response (Kirschbaum & Hellhammer, 1989).

Interestingly, as described above, women displayed a clear relation between self-injurious behavior and cortisol reactivity, while men showed no relation between these factors. This likely points to significant differences in the meanings and functions of self-injury for men and women. It seems that women may engage in self-injury in response to conflictual, depressive, or traumatic experiences, while men may engage in self-injury for reasons such as machismo or displays of strength.

For example, in a separate section of the study, participants are given the opportunity to explain the reasons behind some of their self-injurious behavior. One young man described numerous incidents of self-injury by stating: "If someone tries to hurt me I hit myself to show them that they can't hurt me. I only bite my arm to show people the indent of my crooked teeth. I sometimes punch the wall during arguments." In contrast, a young woman describes her self-injury as occurring: "...when I feel depressed and all pent up emotionally. Oh yes, and when I get very very hurt by someone and upset with someone and just so built up [emotionally] that [I] need some sort of release." While these two examples are simply single accounts of individual experiences, the overall themes that they represent are echoed throughout numerous descriptions. As a result, for women, it seems as though self-injury is clearly related to increased depressive and trauma related experiences. In summary, no relation was found between SIB in men and HPA-axis functioning indicating that men may be utilizing self-injury in different ways and for different reasons than women, and as a result show little connection between SIB and physiological markers of interpersonal stress.

Although there were no basal cortisol level differences between men and women, men showed higher cortisol levels at the anticipatory time point (Cortisol time 2). Several studies have documented patterns of gender differences in basal cortisol levels (Klimes-Dougan et al., 2001) and in cortisol reactivity (Kirschbaum & Hellhammer, 1989). Consistent with the present study, Ennis, Kelly, and Lambert (2001) reported finding that men showed a higher increase in cortisol levels from baseline to pre-test than women. While our difference was not as substantial as that found by Ennis et al (2001), future explorations of sex differences in anticipatory cortisol levels will be helpful toward clarifying this relationship.

Few gender differences within the psychopathology variables were documented. Despite previous research which points to elevations of depressive symptoms in women in late adolescence, we were unable to find this difference. Others have similarly failed to show this difference (Gjerde, Block, & Block, 1988) but simply explain it as an artifact of sampling peculiarities within their sample of adolescents. Similarly, the current study may have failed to find increased depression in women due to overall lower levels of depressive symptoms in our sample, especially in comparison to other studies using similar age groups. Our study is highly involved and time consuming and may, as a result, select mostly participants who are motivated enough to commit to participate in three sessions over the course of six months. As a result, our participants may be less depressed than the general population of college-aged subjects.

We did find that women demonstrated significantly higher levels of trauma symptoms than men. This corresponds with previous findings showing that women are at an increased risk for developing PTSD following exposure to trauma, even when the

increased rates of sexual trauma in women are taken into consideration (Breslau, 2001; Stein, Walker, & Forde, 2000).

In order to assess whether levels of depression or trauma symptoms may be accounting for or clouding the relation of SIB to cortisol, each of these factors was taken into consideration. Interestingly, despite support in the literature for direct connections between depression and PTSD and HPA-axis functioning (Ennis, Kelly, & Lambert, 2001; Kirschbaum & Hellhammer, 1989; Stokes & Sikes, 1987; van der Kolk et al., 1996; Yehuda, Boisoneau et al., 1993; Yehuda, Resnick et al., 1993; Yehuda et al., 1990; Yehuda et al., 1996), these variables only slightly weakened the relation between recent self-injurious behvaior and the time to peak cortisol activity. Surprisingly, these variables did not better account for the connection, and they did not directly carry any significant association with any of the other cortisol variables themselves. Although this is contrary to much of the literature which has found a relation between clinical diagnoses of depression and trauma and HPA-axis functioning (Ennis et al., 2001; Kirschbaum & Hellhammer, 1989; Stokes & Sikes, 1987; van der Kolk et al., 1996; Yehuda, Boisoneau et al., 1993; Yehuda, Resnick et al., 1993; Yehuda et al., 1990; Yehuda et al., 1996), this result is not wholly beyond our understanding. Much research in this area has been inconsistent in finding clear-cut relations between HPA-axis functioning and psychopathology in patient populations, and connections have been even more difficult to pin-point in non-patient populations (Rulf Fountain, 2001). It is possible that the low levels of psychopathology in the current study, have made it hard to find this connection. Nonetheless it is meaningful that although we were unable to replicate previous findings

directly connecting depression and PTSD to HPA activity, we were able to draw a connection between SIB and HPA activity in this sub-clinical sample.

Despite the fact that no direct relation was found between depression, trauma and cortisol variables, both depression and trauma symptoms were shown to moderate the relation between self-injury and anticipatory cortisol levels in women. At higher levels of both trauma and depressive symptomatology, as self-injury scores increased, anticipatory cortisol levels also increased, while at lower levels of psychopathology, the relation was shown to be opposite. For example, in women with high levels of either depressive or trauma symptoms, higher SIB scores led to increased anticipatory cortisol levels. This finding may support the possibility, that even in women, SIB can be utilized for very different reasons. It seems likely that women who engage in SIB but have very low levels of psychological distress may be self-injuring for reasons quite different than those with high psychopathology and the reasons for the behavior may be similar to the reasons for the men. If these women are not using SIB as a way to decrease distress or manage emotions, the relation between increased cortisol and SIB may not hold true. But when we measure HPA activity in women who are distressed and who have higher levels of self-injury, we see a relation between depression, trauma, and the HPA-axis that coincides with the literature (Yehuda et al., 1996). Women with high levels of depression or trauma symptoms are reacting quickly in response to a stressor.

Additionally for women, trauma symptoms are moderating the relation between the time at which they reach peak cortisol levels and self-injurious behavior. This supports findings in the trauma literature (Yehuda et al., 1996), and re-strengthens our earlier finding between SIB recency and time to peak in women. Women who

experience high levels of trauma symptoms reach their peak cortisol level earlier, the more SIB in which they engage. It seems in this case, that women with SIB may react to stressors similarly to individuals with PTSD who are experiencing a novel stressor (Yehuda, Resnick et al., 1993). Their HPA axes react quickly and with a strong response in order to prepare the body to handle the impending crisis.

While some literature suggests that people with trauma symptoms show lower basal cortisol scores (Yehuda et al., 1990; Yehuda et al., 1996), this was not supported by our study. Nonetheless our data did support a relation between basal cortisol levels, self-injury, and depressive symptoms which is consistent with the HPA/depression literature (Gold et al., 1988; Stokes & Sikes, 1987; Yehuda et al., 1996). In women with higher levels of depressive symptoms, increases in basal cortisol levels are positively associated with increases in self-injurious behavior. This supports the theory that individuals who use SIB in conjunction with or in response to depressive symptoms may have more difficulty regulating HPA activity, leading to higher overall cortisol levels even when they are not in acutely stressful situations (Gold et al., 1988; Stokes & Sikes, 1987; Yehuda et al., 1996). Another possibility is that women with high depressive symptoms and high SIB may have shown increased basal scores because they were experiencing this task as a stressor before they even reached the lab. For example, they may have experienced visiting the psychology laboratory as a stressful event in and of itself.

Limitations

Several limitations to the current study are important to point out. Because we used a non-patient, non-clinical sample, variance in levels of psychopathology

symptomatology were limited. Similarly, levels of self-injurious behavior were much lower than would be expected to be seen in a patient population. While this is a limitation, it is also a strength. Because the results were robust enough to be detected in a non-patient population, it is likely that the relations between SIB and HPA-axis reactivity will be measurable in more severe samples as well. Our findings with this sample also strengthen the literature base indicating that HPA-axis dysfunction is present even when symptomatology is not at it's most severe levels.

Differing levels of engagement in the conflict task might also be considered a limitation of the current study. Because individuals choose their own conflict topic, and because they are left alone without the oversight of an experimenter, some individuals may not be fully engaging in the task. Nonetheless, random viewing of some of the conflicts show the couples to be highly involved in the task, despite being left alone. Additionally, avoidance of this type of task by an individual or by a couple, may actually represent how they naturally cope with interpersonal stress in their own lives, and may not correlate with lower HPA-axis reactivity. Future research with these data will examine the relation of HPA-axis reactivity to individual differences in actual coping behaviors within the conflict task.

A final limitation of the current study is the age restrictions on the sample. Due to the age restrictions, generalizability to the population at large is difficult. As stated previously, this age group was consciously chosen for several reasons. Current research on SIB has shown high levels of self-injurious behavior among college-aged adolescents, thus rendering this an extremely relevant age group in which to study the phenomenon (Alexander, 1999; Rulf Fountain, 2001). Additionally, because this is a time period

during which romantic relationships are of increased importance, the use of an interpersonal stressor will likely be quite effective in creating a physiological response (Kirschbaum & Hellhammer, 1989).

Future Research

Because the field of SIB and HPA-axis reactivity is so new, future research areas are extensive so I will only mention a few here. In this study, gender differences in physiological reactivity and SIB emerged as a meaningful and important factor. More systematic research into the reasons for and functions of self-injury for both men and women may clarify gender differences in HPA-axis functioning in relation to these behaviors. Similarly, an assessment of subjects' current and past psychological diagnoses in addition to symptom level measurement would add to the clinical understanding of the participants and enhance understanding of the relations found here.

Current publications are beginning to assess not only salivary and blood cortisol levels, but are also measuring the number of glucocorticoid receptors found throughout the body (Yehuda, Boisoneau et al., 1993). While a study of that magnitude is invasive (involves blood samples) and difficult to complete in a non-patient population, exploring this factor in a non-patient sample of self-injurers would add to our understanding of the complex relationship between behavior and physiology.

Finally, replicating this study with a patient population, including participants with current PTSD, current depression, and ongoing self-injurious behavior will increase the strength and the importance of the current findings. Additionally, a study including a

more severely ill sample will advance our understanding of the progression of the HPA-axis dysfunction in relation to the developmental course of the psychopathology.

Conclusion

In conclusion, the current study demonstrates that self-injury is related to dysregulation of the HPA-axis in response to interpersonal stress, that the relationship between self-injury and interpersonal stress is different for men and women, and that the relation between self-injury and interpersonal stress reactivity in women is moderated by depression and trauma symptoms. Importantly, the current study also demonstrates that this phenomenon is occurring and is measurable even in sub-clinical populations. While the implications of these results on theories of etiology, development, maintenance, and treatment of self-injurious behavior in both clinical populations and the general public is still unclear, understanding the physiological underpinnings and adjustments to complex interpersonal experiences, moves the field closer to developing detailed models of the development, maintenance, and eventually the treatment of self-injurious behavior.

APPENDIX A

CONSENT FORM

DESCRIPTION OF STUDY: The purpose of this study is to learn more about how couples discuss differences. All couples have issues in their relationship about which they disagree. Discussing topics that are sources of disagreement is a normal task involved in having a romantic relationship. We are also interested in learning more about the relations between how couples discuss differences and each individual's history of life events and psychological problems.

The study has THREE SESSIONS, 2 sessions will take place at the UMass lab in Tobin Hall and 1 session will take place by phone. Only session 1 requires that you come to the lab with your partner. Sessions 2 and 3 are individual sessions. You will receive a total of $80 for participation in all three sessions. If you are a UMass undergraduate who is eligible for psychology credit, you will receive 6 credits for the first session 1, $40 for session 2 and an additional 6 credits, and another $40 for completion of all three sessions. If you are not a UMass undergraduate, you will be paid $20 for session 1, $20 for session 2, and an additional $40 for completion of all three sessions. You should participate in this study only if you can participate in ALL THREE sessions.

Session 1: You will be asked to answer questionnaires about your thoughts, your past experiences, and your romantic relationship. You will also provide 7 saliva samples. The saliva samples will be used to measure hormone levels. The saliva samples will also be tested for the amount of blood in your saliva. You and your romantic partner will engage in a 15-minute conflict discussion, which will be videotaped. Later, you will be asked to watch the videotape and answer a questionnaire about your feelings and behavior during the discussion.

Session 2: WITHIN TWO WEEKS, you will participate-INDIVIDUALLY- in an interview. The interview asks questions about your history of life events and psychological problems.

Session 3: SIX MONTHS FROM NOW, you will be contacted by phone for a phone interview about your feelings and thoughts, and your romantic relationship(s) in the 6 months since the last session.

RISKS AND BENEFITS: Although we do not anticipate that participation in this study will cause any discomfort, participation requires drooling into a straw, which may be mildly unpleasant for some people. Further, participation will involve answering questions related to experiences of trauma, loss, and history of psychological problems, which may be upsetting to some people. It is important for you to know that you may discontinue participation at any time if you become uncomfortable. There is no penalty for discontinuation. If you discontinue during a session, you will receive payment (money or credits) for that session, but not for the following sessions. By volunteering as a participant in this study, you will aid us in understanding how people communicate with their romantic partners.

CONFIDENTIALITY: All of the information that you provide in this study will be anonymous and confidential. The only exceptions to this include a life threatening emergency or reported child abuse. Your romantic partner will not have access to any information you provide. Only senior staff of the research project and other professional researchers, will have access to your conflict discussion videotape. Undergraduate staff members will not be allowed access to these videotapes. Your consent form and name will be stored separately from your questionnaire and videotape. Your data will be identified by a study ID number only, and not by name.

We encourage you to ask our staff questions at any time during your involvement. You may also address questions to the Principal Investigator, Dr. Sally Powers, at 545-5964.

We appreciate your participation in the project, and hope that you will find the experience to be interesting and informative.

I have read the above statement of the nature and purpose of the research project and I agree to participate.

_____
Sign name

_____
Print name

_____
Date

APPENDIX B

ADMISSIONS QUESTIONS

ID#_____ DATE_____ SEX: F M

Please answer the following questions about yourself. Please be honest. There are no right or wrong answers. Your information will be kept completely anonymous and confidential. **Please circle ALL that apply.**

A. What medications did you take today?

			dose (mgs.)
1. Antibiotics	yes	no	
2. The pill	yes	no	
3. Aspirin	yes	no	
4. Advil/Tylenol	yes	no	
5. Cold medicine	yes	no	
6. Allergy medicine	yes	no	
7. Asthma medication	yes	no	
8. Norpramin/Pertofrane (Desipramine)	yes	no	
9. Adapin/Sinequan (Doxepin)	yes	no	
10. Anafranil (Chloripramine)	yes	no	
12. Tofranil (Imipramine)	yes	no	
13. Aventyl/Pamelor (Nortriptyline)	yes	no	
14. Triptil/Vivactil (Protriptyline)	yes	no	
15. Surmontil (Trimipramine)	yes	no	
16. Manerix (Moclobemide)	yes	no	
17. Nardil (Pheneizine)	yes	no	
18. Parnate Tranylcypromine)	yes	no	
19. Prozac (Fluoxetine)	yes	no	
20. Luvox (Fluvoxamine)	yes	no	
21. Paxil (Paroxetine)	yes	no	
22. Zoloft (Sertraline)	yes	no	
23. Asendin (Amoxapine)	yes	no	
24. Wellbutrin (Bupropion)	yes	no	
25. Ludiomil (Maprotiline)	yes	no	
26. Remeron (Mirtazapine)	yes	no	
27. Serzone (Nefazodone)	yes	no	
28. Desyrel (Trazodone)	yes	no	
29. Effexor (Venlafaxine)	yes	no	
30. Tegretol (Carbamazepine)	yes	no	

A. What medications did you take today? **dose (mgs.)**

31. Depakene/Depakote/Epival (Phenytion, Primidone, Valproic Acid) yes no
32. Eskalith/Lithane/Lithobid (Lithium) yes no

33. Inapsine (Droperidol) yes no
34. Haldol (Haloperidol) yes no
35. Loxapac/Loxitane (Loxapine) yes no
36. Moban (Molindone) yes no
37. Imap (Fluspirilene) yes no
38. Orap (Pimozide) yes no
39. Largactil/Thorazine (Chlorpromazine) yes no
40. Moditen/Permitil/Prolixin (Fluphenazine) yes no
41. Serentil (Mesoridazine) yes no
42. Nozinan (Methotrimeprazine) yes no
43. Neuleptil (Percyazine) yes no
44. Trilafon (Perphenazine) yes no
45. Piportil L4 (Pipotiazine) yes no
46. Compazine/Stemetil (Prochlorperazine) yes no
47. Sparine (Promazine) yes no
48. Majeptil (Thioproperazine) yes no
49. Mellaril (Thioridazine) yes no
50. Stelazine (Trifluoperazine) yes no
51. Vesprin (Triflupromazine) yes no
52. Fluanxol (Flupenthixol) yes no
53. Navane (Thiothixene) yes no
54. Clopixol (Zuclopenthixol) yes no
55. Clozaril (Clozapine) yes no
56. Zyprexa (Olanzapine) yes no
57. Risperdal (Risperidone) yes no
58. OTHER _____

2. Have you been taking any of the above medication on a daily basis for the past two weeks, but did not take today? **yes** **no**
   a. If yes, what medication? _____

3. Did you smoke any cigarettes today? **yes** **no**
   a. If yes, how long ago did you have your last cigarette? _____ mins.

4. Did you brush your teeth in the last three hours? **yes** **no**

5. When you brushed your teeth today did your gums bleed? **yes** **no**

6. In the past 24 hours, have you had dental work? **yes** **no**

7. In the past 24 hours, have you experienced any injury to your mouth such as burning your mouth or tongue, cutting your mouth or lip, having a sore tooth, any irritation or blisters on your mouth or lips? **yes** **no**

8. In the past 24 hours, have you drunk any alcohol? **yes** **no**

9. In the past 30 minutes, have you had any dairy products? **yes** **no**

9. Did you use any other drugs (marijuana, cocaine, etc.) today?
yes **no**

10. When did you eat or drink last? _____am/pm

11. Did you drink alcohol or take any non-prescription drugs last night?
yes **no**

a) If yes, please describe _____

12. **Record Temperature**_____

13. **(For women only)** Use calendar to fill out **DAY AND LENGTH OF LAST PERIOD, IF CURRENTLY MARK WHEN BEGAN**_____

14. What time did you fall asleep last night? _____

15. What time did you wake up today? _____

16. How many hours of sleep have you gotten in the past 24 hours? _____

APPENDIX C

PARTICIPANT FEEDBACK FORM

The purpose of this study is to learn more about social interactions between romantic partners. Specifically, we were interested in people's thoughts, feelings, and physiological processes involved in conflict negotiation with their romantic partners. The answers you provided on the computer questionnaires will help us gain a better understanding of how romantic partners negotiate conflict, learn more about the thought processes that are activated during conflicts with romantic partners, and better understand the life experiences related to romantic conflict. The saliva samples you provided for us will help us gain a better understanding of the physiological processes that are involved in resolving differences in close relationships.

We expect that some people have stronger emotional and physiological responses to conflict situations than others do. We believe that these responses will, in turn, influence the ways they communicate with their partner. If we can gain a better understanding of the processes involved in conflicts, we will be better able to develop interventions for couples who are involved in troubled romantic relationships.

Sometimes when people discuss their thoughts and feeling about their relationship and past experiences, they decide they would like to further discuss these concerns with a professional counselor. We would like to provide you with the number of three professional counseling services at the University of Massachusetts/Amherst. The Psychological Services Center (PSC) may be contacted from 9-5pm, Monday-Friday. The University Mental Health Services provides a 24-hour service in which you may contact a counselor. The Everywoman's Center provides a 24-hour rape/violence hotline service in which you may contact a trained crisis counselor.

PSC (413) 545-0041
UHS Mental Health division (413) 545-2337
Everywoman's Center (413) 545-0800

We would be happy to provide the results of this study to you if you are interested in obtaining further information about this study. If you have any other questions about this study, please feel free to contact us at (413) 545-5964.

Dr. Sally Powers, Professor of Clinical Psychology
Cheryl Bonica, Clinical Psychology Graduate Student
Eliza McArdle, Clinical Psychology Graduate Student
Anne Smith, Clinical Psychology Graduate Student
Elizabeth Seeley, Clinical Psychology Graduate Student
Meredith Gunlicks, Clinical Psychology Graduate Student

Thank you for your time and participation. Within the week we would like you to participate in a clinical interview about your history of life events and psychological history. At this second session, we would like you to come to the lab individually. A clinical psychology graduate student will conduct the clinical interview. Undergraduate students **will not** be conducting interviews. The interview will require two hours of your time. We will be calling you within the week to confirm the date for the second session. We will also call you the day before the scheduled interview to remind you about the interview.

APPENDIX D

SALIMETRICS CORTISOL ANALYSIS INFORMATION

HS-Cortisol High Sensitivity Salvary Cortisol Enzyme Immunoassay Kit

For Research Use Only, Not For Diagnostic Use

Intended Use
Salimetrics HS-Cortisol kit is a competitive immunoassay specifically designed for the quantitative measurement of salivary cortisol. It is not intended for use with serum/plasma or for diagnostic use. It is intended only for research use with saliva. Please read the complete kit insert before performing this assay. For further information about this kit, its application, or the procedures in this insert, please contact the technical service team at Salimetrics by phone at (800) 790-2258, Fax (814) 234-1608, or online at www.salimetrics.com.

Introduction
At Salimetrics, we know that the current market approach to the application of immunoassay techniques in the measurement of biomarkers in saliva is problematic. This assay kit has been designed to specifically address the following three problems. First, the majority of available immunoassays for saliva cortisol are modifications of protocols developed for the use with serum/plasma. The calibrators used in those assay kits are suspended in a human serum matrix. Given that the composition of serum is markedly different from saliva, these calibrators are likely to produce results that are influenced by matrix differences. To ensure the most accurate results, this salivary immunoassay is designed using a matrix that matches saliva. Second, the level of cortisol in saliva is significantly lower than levels in the general circulation. The use of a standard curve developed to capture the range of values expected in serum/plasma samples is often not sensitive enough to capture the complete range of individual differences in the level expected in saliva. This assay is designed to capture the full range of salivary cortisol levels while using only 25 µl of saliva per test. Third, the pH of saliva is easily lowered or raised by the consumption of food or drink. Performance of immunoassays becomes compromised as the pH of samples to be tested drops below 4 (1). This results in artificially inflated levels. This assay system is designed to be very sensitive to the effects of interference caused by collection techniques that affect pH. In addition, a built-in pH indicator warns the user of acidic or basic samples.

Test Principle
A microtitre plate is coated with rabbit antibodies to cortisol. Cortisol in standards and unknowns compete with cortisol linked to horseradish peroxidase for the antibody binding sites. After incubation, unbound components are washed away. Bound cortisol peroxidase is measured by the reaction of the peroxidase enzyme on the substrate tetramethylbenzidine (TMB). This reaction produces a blue color. A yellow color is formed after stopping the reaction with 2 molar sulfuric acid. Optical Density is read on a standard plate reader at 450 nm. The amount of cortisol peroxidase detected is inversely proportional to the amount of cortisol present (2).

Special Feature
A pH indicator in the assay diluent alerts the user to samples with high or low pH values. Acidic

samples will turn the diluent yellow. Alkaline samples will turn the diluent purple. Dark yellow or purple wells indicate that a pH value for that sample should be obtained using pH strips. Cortisol values from samples with a pH $\leq$ 3.5 or $\geq$ 9.0 may be artificially inflated or lowered (1).

Precautions

1. Stop Solution is a solution of sulfuric acid. This solution is caustic; use with care.
2. This kit may or may not use break-apart microtitre strips. Unused wells must be stored at 4°C in the sealed foil pouch and used in the frame provided.
3. Do not mix components from different lots of kits.
4. When using a multichannel pipette, reagents should be added to duplicate wells at the same time. Follow the same sequence when adding additional reagents so that incubation time with reagents is the same for all wells.
5. See Material Safety Data at the end of procedure.
6. As for all quantitative assays for salivary analytes, we highly recommend that samples be screened for possible blood contamination. This can be efficiently and economically accomplished using Salimetrics Blood Protein EIA Kit (Cat no. 1301). For a description of this assay or an assay kit insert see www.salimetrics.com.
7. Routine calibration of pipettes is critical for the best possible assay performance.
8. Pipetting of samples and reagents must be done as quickly as possible (without interruption) across the plate.

Storage

All components of this kit are stable at 2-8°C until the kit's expiration date.

Reagents and Reagent Preparation

1. Anti-Cortisol Coated Plate: A ready to use microtitre plate pre-coated with antibodies in a resealable foil pouch.
2. Cortisol Standard: Cortisol, at a concentration of 1.8 µg/dL.
3. Wash Buffer: A 10X phosphate buffered solution containing detergents and a non-mercury preservative. Dilute the wash buffer concentrate 10 fold with room temperature deionized water (100 ml of 10X wash buffer to 900 ml of deionized H_20). (*If precipitate has formed in the concentrated wash buffer, it may be heated to 60°C for 15 minutes. Cool to room temperature before use in assay.)
4. Assay Diluent: A phosphate buffered solution containing a pH indicator and a non-mercury preservative.
5. Enzyme Conjugate: A solution of cortisol labeled with horseradish peroxidase.
6. Tetramethylbenzidine (TMB): A non-toxic ready to use solution.
7. Stop Solution: A solution of sulfuric acid in distilled water. (USA customers only). Stop solution is provided in powdered form to customers outside the USA. Reconstitute the powdered stop solution with 12.5 mL of deionized water. Let sit for 20 minutes before use.

8. Non-specific Binding Wells: In order to support multiple use, four extra NSB wells are included in kits containing break-apart plates. They are located inside the foil pouch, in the extra strip. (NOTE: All wells in the extra strip are NSB's!)

Specimen Collection
The preferred saliva collection method (3,4) is to use plain (non-citric acid) cotton Salivettes (Sarstedt). Freeze all saliva samples prior to assay in order to precipitate mucins. Thaw completely, vortex, and centrifuge at 1500 x g (@3000 rpm) for 15 minutes. Pipette clear sample into appropriate wells.

Procedure
Bring all reagents to room temperature.

Step 1: Determine your plate layout. Here is a suggested layout.

	1	2	3	4	5	6	7	8	9	10	11	12
A	1.80 Std	1.80 Std	Control H	Control H								
B	.600 Std	.600 Std	Control L	Control L								
C	.200 Std	.200 Std	Sample 1	Sample 1								
D	.067 Std	.067 Std	Sample 2	Sample 2								
E	.022 Std	.022 Std	Sample 3	Sample 3								
F	.007 Std	.007 Std	Sample 4	Sample 4								
G	Zero	Zero	Sample 5	Sample 5								
H	Nsb	Nsb	Sample 6	Sample 6								

Step 2: If using strip plates, keep the desired number of strips in the strip holder and place the remaining strips back in the foil pouch. Reseal the zip-lock and refrigerate the pouch at 4°C. Caution: Extra NSB wells should not be used for determination of calibrators or unknowns.

Step 3:

- Label five microcentrifuge tubes or other small tubes 2 through 6.
- Pipette 100 µl of assay diluent in tubes 2 through 6.
- Serially dilute the standard 3X by adding 50 µl of the 1.80 µg/dL standard (tube 1) to tube 2. Mix well. After changing pipette tips, remove 50 mL from tube 2 to tube 3. Mix well. Continue for tubes 4, 5, and 6. The final concentrations of standards for tubes 1 through

6 respectively are 1.800 µg/dL, 0.600 µg/dL, 0.200 µg/dL, 0.067 µg/dL, 0.022 µg/dL, and 0.007 µg/dL.

- Values in nmol/L are 49.66, 16.55, 5.52, 1.84, 0.61, and 0.20 nmol/L respectively.)
- Pipette 24 mLs of assay diluent into a disposable tube. Set aside for Step 5.

Step 4:

- Pipette 25 µL of standards and unknowns into appropriate wells. Standards and samples should be assayed in duplicate.
- Pipette 25 µL of assay diluent into 2 wells to serve as the zero.
- Wells H-1, 2 are non-specific binding wells. These wells do not contain any anti-cortisol antibody. Pipette 25 µL of assay diluent into each of these wells to serve as the non-specific binding.

Step 5: Make a 1:1,600 dilution of the conjugate, by adding 15 µL of the conjugate to the 24 mL of assay diluent prepared in Step 3, (full plate only). Immediately mix the diluted conjugate solution and pipette 200 µl into each well using a multichannel pipette.

Step 6: Mix plate on rotator for 5 minutes at 500 rpm (or tap to mix) and incubate at room temperature for an additional 55 minutes.
Step 7: Wash the plate 4 times with 1X wash buffer. A plate washer is recommended. However, washing may be done by gently squirting wash buffer into each well with a squirt bottle or by pipetting 300 µl of wash buffer into each well, and then discarding the liquid by inverting the plate over a sink. After each wash, the plate should be thoroughly blotted on paper towels before being turned upright. If using a plate washer, blotting is still recommended after the last wash.
Step 8: Add 200 µL of TMB solution to each well with a multichannel pipette.
Step 9: Mix on a plate rotator for 5 minutes at 500 rpm (or tap to mix) and incubate the plate in the dark at room temperature for an additional 25 minutes.
Step 10: Add 50 µL of stop solution with a multichannel pipette.

Step 11:

- Mix on a plate rotator for 3 minutes at 500 rpm (or tap to mix). **Caution: DO NOT mix at speeds over 600 rpms. Wells are very full!**
- Wash off bottom of plate with a water-moistened lint-free cloth and wipe dry.
- Read in a plate reader at 450 nm. Read plate within 10 minutes of adding stop solution (correction at 492 to 620 is desirable).

Calculations

1. Compute the average Optical Density (OD) for all duplicate wells.
2. Subtract the average OD for the NSB wells from the average OD of the zero, standards, and unknowns.
3. Calculate the percent bound (B/BO) for each standard by dividing the average OD (B) by the average OD for the zero (BO).
4. If calculating the results by hand, plot B/BO on the vertical axis against the log of the concentration on the horizontal axis for each calibrator and draw a straight line through the points. Determine the concentrations of the unknowns by interpolation.

5. If using software capable of logistics, use a 4 parameter sigmoid minus curve fit. Otherwise, use log-linear regression.

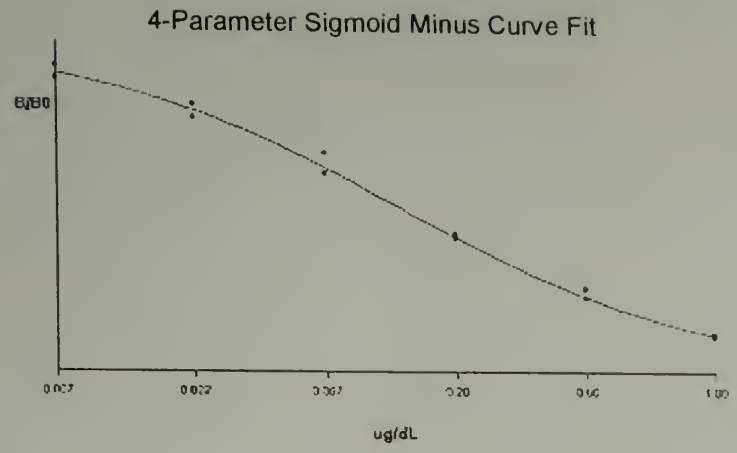
Typical Results

The following charts and graphs are for illustration only and **SHOULD NOT** be used to calculate results from another assay.

Well	Sample	Average OD	B	B/Bo	Cortisol (ug/dL)
A1,A2	S1	0.229	0.205	0.1207	1.613
B1,B2	S2	0.419	0.395	0.2326	0.757
C1,C2	S3	0.737	0.713	0.4199	0.214
D1,D2	S4	1.090	1.066	0.6278	0.052
E1,E2	S5	1.330	1.306	0.7691	0.020
F1,F2	S6	1.561	1.537	0.9052	0.008
G1,G2	B0	1.722	1.698	NA	
H1,H2	NSB	0.024	NA	NA	

Example: Standard Curves

Log-Linear Regression



Material Safety Data*

Hazardous Ingredients
Stop Solution is a solution of sulfuric acid. This solution is caustic; use with care. We recommend the procedures listed below for all kit reagents.

Handling
Follow good laboratory procedures when handling kit reagents. Laboratory coats, gloves, and safety goggles are recommended. Wipe up spills using standard absorbent materials while wearing protective clothing. Follow local regulations for disposal.

Emergency Exposure Measures
In case of contact, immediately wash skin or flush eyes with water for 15 minutes. Remove contaminated clothing. If inhaled, remove individual to fresh air. If individual experiences difficulty breathing, give oxygen and call a physician.

*The above information is believed to be accurate but is not all-inclusive. This information should only be used as a guide. Salimetrics shall not be liable for accidents or damage resulting from contact with reagents.

References
1. Schwartz, E.B., Granger, D.A., Susman, E.J., Gunnar, M.R., & Laird, B. (1998). Assessing Salivary Cortisol in Studies of Child Development. Child Development, 69, 1503-1513.
2. Chard, T. (1990). An Introduction to Radioimmunoassay and Related Techniques. Elsevier, Amsterdam.
3. Clements, A.D., & Parker, C.R. (1998). The Relationship Between Salivary Cortisol Concentrations in Frozen Versus Mailed Samples. Psychoneuroendocrinology, 23, 613-616.
4. Kirschbaum, C., Read, G.F., & Hellhammer, D.H. (1992). Assessment of Hormones and Drugs in Saliva in Biobehavioral Research. Kirkland, WA: Hogefe & Huber Publishers.

HS Cortisol EIA Assay Performance Characteristics

Recovery: Two saliva samples containing different levels of endogenous cortisol were spiked with known quantities of cortisol and assayed.

Sample	Endogenous (ug/dL)	Added (ug/dL)	Expected (ug/dL)	Observed (ug/dL)	Recovery (%)
1	0.41	0.54	0.95	0.825	86.8%
		0.04	0.450	0.390	86.7%
2	0.111	0.54	0.651	0.614	94.3%
		0.04	0.151	0.136	90.1%

Precision:

1. The intra-assay precision was determined from the mean of 10 replicates each.

Sample	N	Mean (ug/dL)	Standard Deviation (ug/dL)	Coefficient of Variation (%)
H	10	0.897	0.01	3.88%
M	10	0.51	0.03	6.22%
L	10	0.14	0.01	7.12%

2. The inter-assay precision was determined from the mean of average duplicates for ten separate runs.

Sample	N	Mean (ug/dL)	Standard Deviation (ug/dL)	Coefficient of Variation (%)
H	10	0.538	0.04	6.69%
L	10	0.129	0.01	6.88%

Linearity of Dilution: Three saliva samples were diluted with PBS and assayed.

Sample	Dilution Factor Expected	Factor Expected (ug/dL)	Observed (ug/dL)	Recovery (%)
1			0.513	
	1:2	0.256	0.271	105.8%
	1:4	0.128	0.134	104.7%

	1:8	0.64	0.057	89%
	1:16	0.032	0.036	112.5%
	1:32	0.016	0.015	93.8%
2			0.141	
	1:2	0.071	0.068	95.8%
	1:4	0.035	0.035	100%
	1:8	0.018	0.020	111.1%
3			0.387	
	1:2	0.193	0.199	103.1%
	1:4	0.097	0.100	103.1%
	1:8	0.048	0.054	112.5%
	1:16	0.024	0.023	95.8%
	1:32	0.012	0.011	97.7%

Sensitivity: The lower limit of sensitivity was determined by interpolating the mean minus 2SD for 10 sets of duplicates at 0 ug/dL standard. The minimal concentration of cortisol that can be distinguished from 0 is $\leq$.007 ug/dL.

Correlation with Serum: The correlation between serum and saliva cortisol was determined by assaying 19 matched samples using the Diagnostic Products Corporation serum Coat-a-Count Cortisol RIA and the Salimetrics HS Salivary Cortisol EIA.

The correlation between saliva and serum was highly significant, $r(17) = 0.960$, $p \leq 0.0001$.

Seller's Limited Warranty
"Seller warrants that all goods sold hereunder will be free from defects in material and workmanship. Upon prompt notice by Buyer of any claimed defect, which notice must be sent within thirty (30) days from date such defect is first discovered and within six months from the date of shipment, Seller shall, at its option, either repair or replace the product that is proved to Seller's satisfaction to be defective. This warranty does not cover any damage due to accident, misuse, negligence, or abnormal use.

It is expressly agreed that this limited warranty shall be in lieu of all warranties of fitness and in lieu of the warranty of merchantability. Seller shall not be liable for any incidental or consequential damages that arise out of the installation, use or operation of Seller's product or out of the breach of any express or implied warranties."

Cortisol Specificity

In the HS Salivary Cortisol EIA, the following compounds were tested at concentrations up to 66,000 ng/mL for cross-reactivity:

Compound	Spiked Concentration(Ng/mL)	% Cross-reactivityin HS Salivary Cortisol EIA
Prednisolone	100	09.530
Prednisone	1000	0.421
Cortisone	1000	0.31
11-Deoxycortisol	500	3.116
21-Deoxycortisol	1000	0.745
17-a Hydroxy-progesterone	1000	0.611
Dexamethasone	1000	1.277
Triamcinolone	1000	0.430
Corticosterone	10,000	0.093
Progesterone	1000	00.060
DHEA	10,000	ND
Testosterone	10,000	ND
Transferrin	66,000	ND
Aldosterone	10,000	ND

ND = non-detectable (<0.004)

APPENDIX E

DEMOGRAPHICS QUESTIONS

a) Gender: Male Female

b) What is your ethnic/racial group?

__Asian/Asian American or Pacific Islander
__African/African American
__Latino/Hispanic (e.g., Cuban, Puerto Rican, Mexican)
__Native American
__White/Caucasian
__Other_____

c) Date of Birth_____

d) AGE_____

e) Using the scale below, what is your mother's highest level of education?
__High School or trade school
__Some College
__College graduate
__Some graduate school
__Graduate degree (masters, doctorate, or professional degree)

f) Using the scale below, what is your father's highest level of education?
__High School or trade school
__Some College
__College graduate
__Some graduate school
__Graduate degree (masters, doctorate, or professional degree)

g) What is your mother's occupation?
_____ full-time part-time unemployed

h) What is your father's occupation?
_____ full-time part-time unemployed

APPENDIX F

CES-D

The statements on this page are about how people feel sometimes. Please put an "X" to indicate the number of days you have felt that way in the last week. Include today as part of that week.

During the Past Week:	Rarely	A little	Moderate	Most
	(Less than 1 day)	(1 to 2 days)	(3-4 days)	(5-7 days)
1. I was bothered by things that usually don't bother me.				
2. I did not feel like eating; my appetite was poor.				
3. I felt that I could not shake off the blues even with help from my family and friends.				
4. I felt that I was just as good as other people.				
5. I had trouble keeping my mind on what I was doing.				
6. I felt depressed.				
7. I felt that everything I did was an effort.				
8. I felt hopeful about the future.				
9. I thought that my life had been a failure.				
10. I felt fearful.				
11. My sleep was restless.				
12. I was happy.				
13. I talked less than usual.				
14. I felt lonely.				
15. People were unfriendly.				
16. I enjoyed life.				
17. I had crying spells.				
18. I felt sad.				
19. I felt that people disliked me.				
20. I could not get going.				

APPENDIX G

TRAUMA SYMPTOM CHECKLIST – 40

How often have you experienced each of the following in the **last two months?**

	Never			Often
1) Headaches	0	1	2	3
2) Insomnia (trouble getting to sleep)	0	1	2	3
3) Weight loss (without dieting)	0	1	2	3
4) Stomach problems	0	1	2	3
5) Sexual problems	0	1	2	3
6) Feeling isolated from others	0	1	2	3
7) "Flashbacks" (sudden, vivid, distracting memories)	0	1	2	3
8) Restless sleep	0	1	2	3
9) Low sex drive	0	1	2	3
10) Anxiety attacks	0	1	2	3
11) Sexual overactivity	0	1	2	3
12) Loneliness	0	1	2	3
13) Nightmares	0	1	2	3
14) "Spacing out" (going away in your mind)	0	1	2	3
15) Sadness	0	1	2	3
16) Dizziness	0	1	2	3
17) Not feeling satisfied with your sex life	0	1	2	3
18) Trouble controlling your temper	0	1	2	3
19) Waking up early in the morning and can't get back to sleep	0	1	2	3

How often have you experienced each of the following in the **last two months?

	Never			Often
20) Uncontrollable crying	0	1	2	3
21) Fear of men	0	1	2	3
22) Not feeling rested in the morning	0	1	2	3
23) Having sex that you didn't enjoy	0	1	2	3
24) Trouble getting along with others	0	1	2	3
25) Memory problems	0	1	2	3
26) Desire to physically hurt yourself	0	1	2	3
27) Fear of women	0	1	2	3
28) Waking up in the middle of the night	0	1	2	3
29) Bad thoughts or feelings during sex	0	1	2	3
30) Passing out	0	1	2	3
31) Feeling that things are "unreal"	0	1	2	3
32) Unnecessary or over-frequent washing	0	1	2	3
33) Feelings of inferiority	0	1	2	3
34) Feeling tense all the time	0	1	2	3
35) Being confused about your sexual feelings	0	1	2	3
36) Desire to physically hurt others	0	1	2	3
37) Feelings of guilt	0	1	2	3
38) Feelings that you are not always in your body	0	1	2	3
39) Having trouble breathing	0	1	2	3
40) Sexual feelings when you shouldn't have them	0	1	2	3

APPENDIX H

SELF-INJURY QUESTIONNAIRE

Sometimes people engage in behaviors that are harmful to their bodies. These behaviors are sometimes accidental, and sometimes intentional. Please answer these questions with respect to intentional behavior. Please indicate *when* was the last time you engaged in such behavior, as well as the frequency with which the behavior has occurred over your lifetime. If "never" please choose this option.

1. Have you ever engaged in any behavior that was *deliberately* harmful to your body? (i.e. you harmed yourself *on purpose*.)

Most recent Time:
- a) Never
- b) in the past week
- c) in the past month
- d) in past 6 months
- e) in the past year
- f) over 1 year ago (within 5 years)
- g) over 5 years ago

Frequency:
- a) None
- b) one time in my life
- c) between 2-5 times in my life
- d) between 6-10 times in my life
- e) between 11-20 times in my life
- f) over 20 times in my life

2. Have you ever intentionally engaged in behavior that produced bruising?

Most recent Time:
- a) Never
- b) in the past week
- c) in the past month
- d) in past 6 months
- e) in the past year
- f) over 1 year ago (within 5 years)
- g) over 5 years ago

Frequency:
- a) None
- b) one time in my life
- c) between 2-5 times in my life
- d) between 6-10 times in my life
- e) between 11-20 times in my life
- f) over 20 times in my life

3. Have you ever deliberately hit yourself?

Most recent Time:
- a) Never
- b) in the past week
- c) in the past month
- d) in past 6 months
- e) in the past year
- f) over 1 year ago (within 5 years)
- g) over 5 years ago

Frequency:
- a) None
- b) one time in my life
- c) between 2-5 times in my life
- d) between 6-10 times in my life
- e) between 11-20 times in my life
- f) over 20 times in my life

4. Have you ever intentionally pulled out your hair or eyelashes?

Most recent Time:
a) Never
b) in the past week
c) in the past month
d) in past 6 months
e) in the past year
f) over 1 year ago (within 5 years)
g) over 5 years ago

Frequency:
a) None
b) one time in my life
c) between 2-5 times in my life
d) between 6-10 times in my life
e) between 11-20 times in my life
f) over 20 times in my life

5. Have you ever purposely scratched yourself with fingernails or other objects hard enough to leave marks or cause bleeding?

Most recent Time:
a) Never
b) in the past week
c) in the past month
d) in past 6 months
e) in the past year
f) over 1 year ago (within 5 years)
g) over 5 years ago

Frequency:
a) None
b) one time in my life
c) between 2-5 times in my life
d) between 6-10 times in my life
e) between 11-20 times in my life
f) over 20 times in my life

6. Have you ever deliberately bit yourself hard enough to leave marks?

Most recent Time:
a) Never
b) in the past week
c) in the past month
d) in past 6 months
e) in the past year
f) over 1 year ago (within 5 years)
g) over 5 years ago

Frequency:
a) None
b) one time in my life
c) between 2-5 times in my life
d) between 6-10 times in my life
e) between 11-20 times in my life
f) over 20 times in my life

7. Have you ever purposely eaten toxic substances or sharp objects?

Most recent Time:
a) Never
b) in the past week
c) in the past month
d) in past 6 months
e) in the past year
f) over 1 year ago (within 5 years)
g) over 5 years ago

Frequency:
a) None
b) one time in my life
c) between 2-5 times in my life
d) between 6-10 times in my life
e) between 11-20 times in my life
f) over 20 times in my life

8. Have you ever intentionally burned yourself with a lit cigarette, match, or other?

Most recent Time:

a) Never
b) in the past week
c) in the past month
d) in past 6 months
e) in the past year
f) over 1 year ago (within 5 years)
g) over 5 years ago

Frequency:

a) None
b) one time in my life
c) between 2-5 times in my life
d) between 6-10 times in my life
e) between 11-20 times in my life
f) over 20 times in my life

9. Have you ever purposely cut or gouged yourself with a razor blade, broken glass, or other?

Most recent Time:

a) Never
b) in the past week
c) in the past month
d) in past 6 months
e) in the past year
f) over 1 year ago (within 5 years)
g) over 5 years ago

Frequency:

a) None
b) one time in my life
c) between 2-5 times in my life
d) between 6-10 times in my life
e) between 11-20 times in my life
f) over 20 times in my life

APPENDIX I

TABLES

Table 1. Descriptive statistics and sex differences in psychopathology variables

Variables	**Men**			**Women**			**skew**	**kurtosis**	**range**	**t**
	N	*Mean*	*SD*	*N*	*Mean*	*SD*				
TSC-40	85	23.26	10.59	85	28.42	11.22	.21	-0.20	53.00	-3.09***
CES-D	85	10.18	6.72	85	10.64	7.06	1.07	1.03	35.00	-.043
SIB weighted	85	48.09	122.55	85	46.39	118.62	3.40	12.38	770.00	0.09
SIB severity	85	0.26	0.44	85	0.26	0.44	1.11	-.78	1.00	0.00
SIB frequency	61	1.02	1.41	62	1.11	1.43	1.14	0.31	5.00	-0.38
SIB recency	84	0.82	1.32	82	1.00	1.63	1.64	1.99	6.00	-0.77

***$p<0.002$

Table 2. Descriptive statistics and sex differences in cortisol variables

Variables	Men			Women			skew	kurtosis	range	t
	N	*Mean*	*SD*	*N*	*Mean*	*SD*				
Cortisol Time 1 (ug/dl)	85	0.24	0.15	85	0.21	0.14	2.84	11.57	1.01	1.10
Cortisol Time 2 (ug/dl)	85	0.29	0.19	85	0.24	0.14	2.34	7.46	1.08	1.96*
Cortisol Time 3 (ug/dl)	85	0.27	0.17	85	0.25	0.19	2.38	7.90	1.17	0.63
Cortisol Time 4 (ug/dl)	84	0.24	0.14	85	0.22	0.14	1.65	3.83	0.90	0.53
Cortisol Time 5 (ug/dl)	85	0.21	0.12	85	0.22	0.15	1.74	3.83	0.73	-0.67
Cortisol Time 6 (ug/dl)	85	0.18	0.09	85	0.21	0.13	1.33	1.99	0.61	-1.29
Cortisol Time 7 (ug/dl)	85	0.18	0.09	85	0.20	0.12	1.71	5.64	0.77	-1.34
Cortisol Reactivity (ug/dl)	85	0.11	0.15	85	0.09	0.11	2.33	6.82	0.76	0.91
Cortisol Peak Time (minutes)	85	27.29	25.27	85	28.65	29.00	0.88	-0.17	90.00	-0.32
Cortisol Recovery (ug/dl)	85	0.007	0.13	85	0.01	0.12	1.57	6.30	0.96	2.44**

*p<0.05 **p<0.02

Table 3. Frequencies of the recency of all types of SIB

	Any Self-Harm		Self Bruising		Self Hitting		Hair Pulling		Self Scratching		Self Biting		Self Poisoning		Self Burning		Self Cutting	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Never N (%)	67 (78.8)	55 (64.7)	65 (76.5)	73 (85.9)	67 (78.8)	66 (77.6)	74 (87.1)	68 (80.0)	72 (84.7)	59 (69.4)	62 (72.9)	71 (83.5)	82 (96.5)	77 (90.6)	76 (89.4)	75 (88.2)	81 (95.3)	71 (83.5)
In the past week N (%)	1 (1.2)	1 (1.2)	1 (1.2)	0 (0)	1 (1.2)	0 (0)	3 (3.5)	2 (2.4)	0 (0)	1 (1.2)	0 (0)	1 (1.2)	0 (0)	1 (1.2)	0 (0)	0 (0)	0 (0)	0 (0)
In the past month N (%)	4 (4.7)	3 (3.5)	3 (3.5)	0 (0)	0 (0)	0 (0)	1 (1.2)	0 (0)	0 (0)	1 (1.2)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.2)	0 (0)	0 (0)	1 (1.2)
In the past 6 months N (%)	1 (1.2)	2 (2.4)	4 (4.7)	2 (2.4)	3 (3.5)	2 (2.4)	1 (1.2)	0 (0)	1 (1.2)	1 (1.2)	3 (3.5)	2 (2.4)	0 (0)	0 (0)	1 (1.2)	0 (0)	0 (0)	0 (0)
In the past year N (%)	5 (5.9)	4 (4.7)	5 (5.9)	1 (1.2)	3 (3.5)	1 (1.2)	0 (0)	3 (3.5)	2 (2.4)	3 (3.5)	4 (4.7)	4 (4.7)	0 (0)	0 (0)	1 (1.2)	0 (0)	1 (1.2)	1 (1.2)
In the past 5 years N (%)	4 (4.7)	10 (11.8)	5 (5.9)	6 (7.1)	8 (9.4)	9 (10.6)	2 (2.4)	8 (9.4)	5 (5.9)	10 (11.8)	9 (10.6)	2 (2.4)	1 (1.2)	2 (2.4)	4 (4.7)	4 (4.7)	1 (1.2)	3 (3.5)
Over 5 years ago N (%)	2 (2.4)	7 (8.2)	1 (1.2)	1 (1.2)	2 (2.4)	5 (5.9)	2 (2.4)	1 (1.2)	3 (3.5)	7 (8.2)	6 (7.1)	2 (2.4)	1 (1.2)	2 (2.4)	1 (1.2)	2 (2.4)	0 (0)	6 (7.1)
Missing N (%)	1 (1.2)	3 (3.5)	1 (1.2)	2 (2.4)	1 (1.2)	2 (2.4)	2 (2.4)	3 (3.5)	2 (2.4)	3 (3.5)	1 (1.2)	3 (3.5)	1 (1.2)	3 (3.5)	1 (1.2)	4 (4.7)	2 (2.4)	3 (3.5)

Table 4. Frequencies of SIB in the current sample

	Any Self-Harm		Self Bruising		Self Hitting		Hair Pulling		Self Scratching		Self Biting		Self Poisoning		Self Burning		Self Cutting	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Never N (%)	44 (51.8)	36 (42.4)	42 (49.4)	48 (56.5)	41 (48.2)	42 (49.4)	45 (52.9)	45 (52.9)	47 (55.3)	35 (41.2)	37 (43.5)	46 (54.1)	51 (60.0)	50 (58.8)	49 (57.6)	48 (56.5)	51 (60.0)	47 (55.3)
1 time N (%)	3 (3.5)	6 (7.1)	3 (3.5)	1 (1.2)	4 (4.7)	4 (4.7)	0 (0)	1 (1.2)	0 (0)	4 (4.7)	4 (4.7)	2 (2.4)	2 (2.4)	3 (3.5)	2 (2.4)	2 (2.4)	0 (0)	5 (5.9)
2-5 times N (%)	11 (12.9)	12 (14.1)	8 (9.4)	7 (8.2)	7 (8.2)	9 (10.6)	3 (3.5)	5 (5.9)	9 (10.6)	9 (10.6)	12 (14.1)	5 (5.9)	0 (0)	1 (1.2)	5 (5.9)	3 (3.5)	2 (2.4)	5 (5.9)
6-10 times N (%)	0 (0)	4 (4.7)	1 (1.2)	2 (2.4)	1 (1.2)	3 (3.5)	1 (1.2)	3 (3.5)	0 (0)	5 (5.9)	0 (0)	3 (3.5)	0 (0)	0 (0)	0 (0)	1 (1.2)	0 (0)	0 (0)
11-20 times N (%)	1 (1.2)	3 (3.5)	3 (3.5)	0 (0)	2 (2.4)	0 (0)	1 (1.2)	2 (2.4)	1 (1.2)	5 (5.9)	3 (3.5)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (1.2)
Over 20 times N (%)	2 (2.4)	2 (2.4)	3 (3.5)	0 (0)	2 (2.4)	0 (0)	3 (3.5)	2 (2.4)	0 (0)	1 (1.2)	2 (2.4)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Missing* N (%)	24 (28.2)	22 (25.9)	25 (29.4)	27 (31.8)	28 (32.9)	27 (31.8)	32 (37.6)	27 (31.8)	28 (32.9)	26 (30.6)	27 (31.8)	29 (34.1)	32 (37.6)	31 (36.5)	29 (34.1)	31 (36.5)	32 (37.6)	27 (31.8)

* Composed exclusively of individuals who reported "never" having engaged in the behavior on the previous question

Table 5. Pearson correlations of self-injury variables and psychopathology measures.

	Men		Women	
SIB Measure	**TSC-40**	**CES-D**	**TSC-40**	**CES-D**
SIB Weighted	0.084 (N=85)	-0.030 (N=85)	0.337** (N=85)	0.162 (N=85)
SIB Severity Score	0.171 (N=85)	0.110 (N=85)	0.421*** (N=85)	0.363*** (N=85)
SIB Frequency	0.164 (N=61)	0.026 (N=62)	0.469*** (N=62)	0.461*** (N=62)
SIB Recency	0.188^ (N=84)	0.001 (N=82)	0.351*** (N=82)	0.286* (N=82)

^p<0.09 *p<0.01 **p<0.002 ***p<0.001

Table 6. Paired T-tests comparing basal and maximum cortisol levels

Variables	**Men (n=85)**			**Women (n=85)**		
	mean	*SD*	*t*	*Mean*	*SD*	*t*
Basal Cortisol (ug/dl)	0.24	0.15	-6.90*	0.21	0.14	-7.75*
Maximum Cortisol (ug/dl)	0.35	0.22		0.31	0.20	

*p<.0001

Table 7. Pearson correlations of cortisol variables and physiological control variables for men.

	Awake Time	Hours of Sleep	Anti-biotic	Advil – Tylenol	Cold Meds	Allergy Meds	Asthma Meds	Alcohol
Basal Cortisol	0.03 (N=84)	0.05 (N=84)	0.06 (N=84)	-0.02 (N=84)	-0.04 (N=84)	0.07 (N=84)	0.16 (N=84)	**0.53**** (N=81)
Anticipatory Cortisol	-0.10 (N=84)	-0.14 (N=84)	-0.07 (N=84)	-0.05 (N=84)	0.01 (N=84)	**0.25*** (N=84)	0.09 (N=84)	**0.28*** (N=81)
Cortisol Time 3	-0.03 (N=84)	0.12 (N=84)	-0.03 (N=84)	0.03 (N=84)	-0.04 (N=84)	**0.42**** (N=84)	**0.28*** (N=84)	0.06 (N=81)
Cortisol Time 4	-0.01 (N=83)	0.15 (N=83)	-0.07 (N=83)	0.05 (N=83)	0.01 (N=83)	**0.35**** (N=83)	**0.26*** (N=83)	0.15 (N=81)
Cortisol Time 5	-0.10 (N=84)	0.03 (N=84)	-0.09 (N=84)	0.03 (N=84)	-0.02 (N=84)	**0.39**** (N=84)	0.15 (N=84)	0.12 (N=81)
Cortisol Time 6	-0.04 (N=84)	0.02 (N=84)	-0.07 (N=84)	-0.08 (N=84)	-0.04 (N=84)	**0.33**** (N=84)	0.19 (N=84)	0.12 (N=81)
Cortisol Time 7	-0.04 (N=84)	-0.06 (N=84)	-0.03 (N=84)	-0.07 (N=84)	-0.07 (N=84)	**0.44**** (N=84)	0.12 (N=84)	**0.23*** (N=81)
Cortisol Reactivity	-0.08 (N=84)	-0.09 (N=84)	-0.08 (N=84)	0.06 (N=84)	0.01 (N=84)	**0.57**** (N=84)	0.11 (N=84)	-0.11 (N=81)
Cortisol Peak Time	0.05 (N=84)	0.05 (N=84)	-0.12 (N=84)	-0.09 (N=84)	-0.08 (N=84)	0.12 (N=84)	-0.10 (N=84)	**-0.25*** (N=81)
Extent of recovery	0.07 (N=84)	0.10 (N=84)	0.08 (N=84)	0.02 (N=84)	-0.00 (N=84)	**-0.22*** (N=84)	0.10 (N=84)	**0.43**** (N=81)

*p<0.05 **p<0.01

Table 8. Pearson correlations of cortisol variables and physiological control variables for women.

	Awake Time	Hours of Sleep	Anti-biotic	Birth Control	Aspirin	Advil/ Tylenol	Cold Meds	Allergy Meds	Asthma Meds	SSRI's
Basal Cortisol	-0.07 (N=84)	0.02 (N=84)	0.07 (N=85)	0.02 (N=85)	-0.04 (N=85)	-0.06 (N=85)	0.06 (N=85)	-0.01 (N=85)	-0.04 (N=85)	**0.30**** (N=85)
Anticipatory Cortisol	-0.03 (N=84)	0.02 (N=84)	0.05 (N=85)	0.11 (N=85)	-0.06 (N=85)	0.00 (N=85)	-0.03 (N=85)	0.21 (N=85)	-0.01 (N=85)	0.16 (N=85)
Cortisol Time 3	-0.10 (N=84)	-0.02 (N=84)	0.13 (N=85)	0.14 (N=85)	-0.08 (N=85)	-0.06 (N=85)	-0.04 (N=85)	0.11 (N=85)	0.00 (N=85)	0.02 (N=85)
Cortisol Time 4	-0.09 (N=84)	-0.00 (N=84)	0.20 (N=85)	**0.22*** (N=85)	-0.09 (N=85)	-0.03 (N=85)	0.01 (N=85)	0.18 (N=85)	-0.08 (N=85)	0.00 (N=85)
Cortisol Time 5	-0.04 (N=84)	0.14 (N=84)	0.17 (N=85)	0.12 (N=85)	-0.09 (N=85)	-0.09 (N=85)	-0.01 (N=85)	0.02 (N=85)	-0.04 (N=85)	**0.40**** (N=85)
Cortisol Time 6	-0.11 (N=84)	-0.01 (N=84)	0.14 (N=85)	0.21 (N=85)	-0.09 (N=85)	-0.05 (N=85)	0.06 (N=85)	0.08 (N=85)	-0.02 (N=85)	0.11 (N=85)
Cortisol Time 7	-0.04 (N=84)	0.19 (N=84)	0.02 (N=85)	0.15 (N=85)	-0.11 (N=85)	-0.04 (N=85)	0.03 (N=85)	-0.03 (N=85)	-0.02 (N=85)	**0.54**** (N=85)
Cortisol Reactivity	-0.14 (N=84)	-0.04 (N=84)	0.07 (N=85)	0.02 (N=85)	-0.09 (N=85)	-0.09 (N=85)	-0.05 (N=85)	0.20 (N=85)	-0.01 (N=85)	**0.23*** (N=85)
Cortisol Peak Time	-0.06 (N=84)	0.04 (N=84)	-0.09 (N=85)	0.04 (N=85)	-0.11 (N=85)	-0.16 (N=85)	0.05 (N=85)	-0.07 (N=85)	0.04 (N=85)	0.12 (N=85)
Extent of recovery	-0.05 (N=84)	-0.18 (N=84)	0.07 (N=85)	-0.13 (N=85)	0.07 (N=85)	-0.03 (N=85)	0.04 (N=85)	0.02 (N=85)	-0.02 (N=85)	**-0.22*** (N=85)

*p<0.05 **p<0.01

Table 9. Summary of simultaneous regression Analyses for variables predicting Cortisol Time to Peak reactivity in women (N=82)

Variable	B	SE	ß	F
SSRIs	61.36	28.39	0.23*	4.43**
SIB recency	-3.94	1.93	-0.22*	

*p<.05 **p<.02

Table 10. Summary of simultaneous regression analyses for variables predicting cortisol time to peak reactivity in women controlling for depressive and trauma symptoms (N=82)

Variable	B	SE	ß	F
SSRIs	54.79	30.20	0.205*	2.38**
CES-D	0.37	0.54	0.09	
TSC-40	-0.25	0.33	-0.10	
SIB recency	-3.68	2.06	-0.20*	

*p<.08 **p<.06

Table 11. Summary of simultaneous regression analyses assessing trauma as a moderator of the relation between self-injury and anticipatory cortisol levels in women (N=85)

Variable	B	SE	ß	F
Allergy meds	0.28	0.14	0.22*	2.60**
SSRIs	0.22	0.14	0.17	
SIB-weighted	-0.0001	0.000	-0.09	
TSC-40	0.0005	0.001	0.04	
TSC*SIBcont	0.00002	0.000	0.323**	

*p<.05 **p<.04

Table 12. Summary of simultaneous regression analyses assessing trauma as a moderator of the relation between self-injury and time of peak cortisol levels in women (N=85)

Variable	B	SE	ß	F
Allergy meds	-21.84	28.75	-0.08	
SSRIs	61.38	28.64	0.23**	
SIB-weighted	0.058	0.04	0.23	1.83^
TSC-40	-0.29	0.31	-0.11	
TSC*SIBcont	-0.004	0.002	-0.26*	

^p<0.11 *p<0.09 **p<0.04

Table 13. Summary of simultaneous regression analyses assessing depression as a moderator of the relation between self-injury and basal cortisol levels in women (N=85)

Variable	B	SE	ß	F
Allergy meds	0.012	0.14	0.01	
SSRIs	0.43	0.15	0.33**	
SIB-weighted	0.00008	0.00	0.07	2.45*
CES-D	-0.0008	0.002	-0.04	
CESD*SIBcont	0.000043	0.00	0.218*	

*p<.05 **p<.01

Table 14. Summary of simultaneous regression analyses assessing depression as a moderator of the relation between self-injury and anticipatory cortisol levels in women (N=85)

Variable	B	SE	ß	F
Allergy meds	0.30	0.14	0.23**	2.59**
SSRIs	0.28	0.15	0.21*	
SIB-weighted	0.00015	0.000	0.12	
CES-D	-0.0011	0.002	-0.06	
CESD*SIBcont	0.000048	0.000	0.24**	

*p<.07 **p<.04

APPENDIX J

FIGURES

Figure 1. Mean cortisol levels by sex across time points

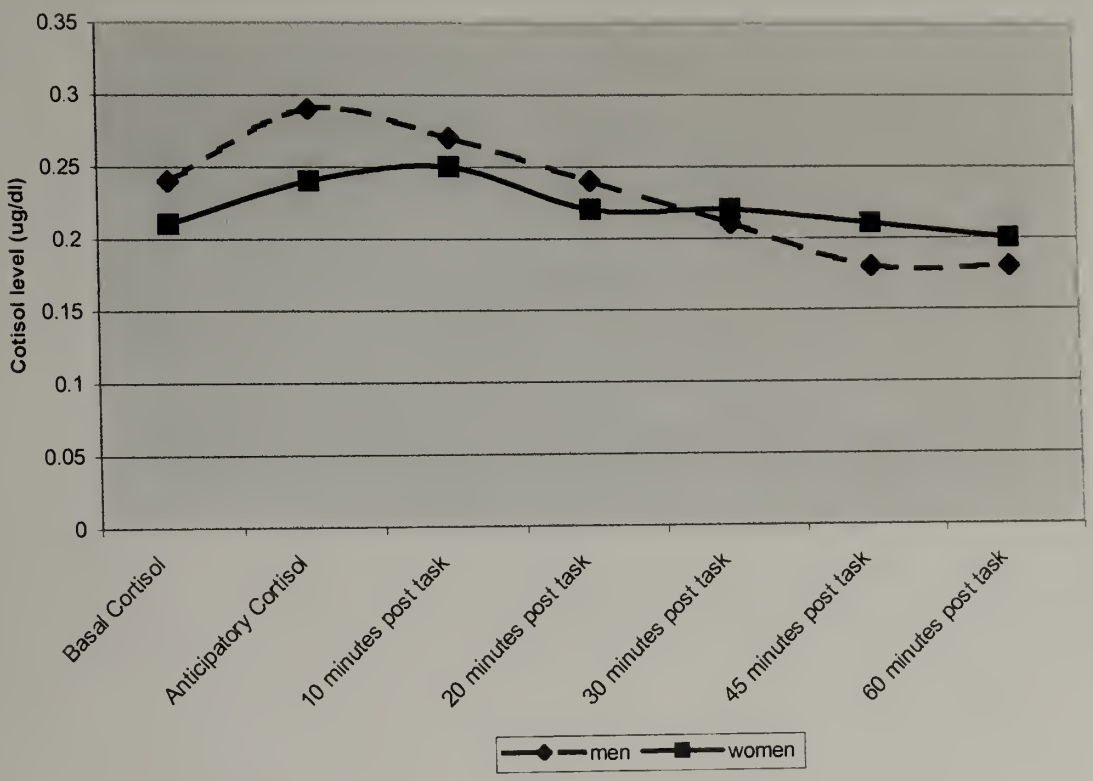


Figure 2. Women's trauma symptoms moderate the relation between self-injury scores and the time to peak cortisol level.

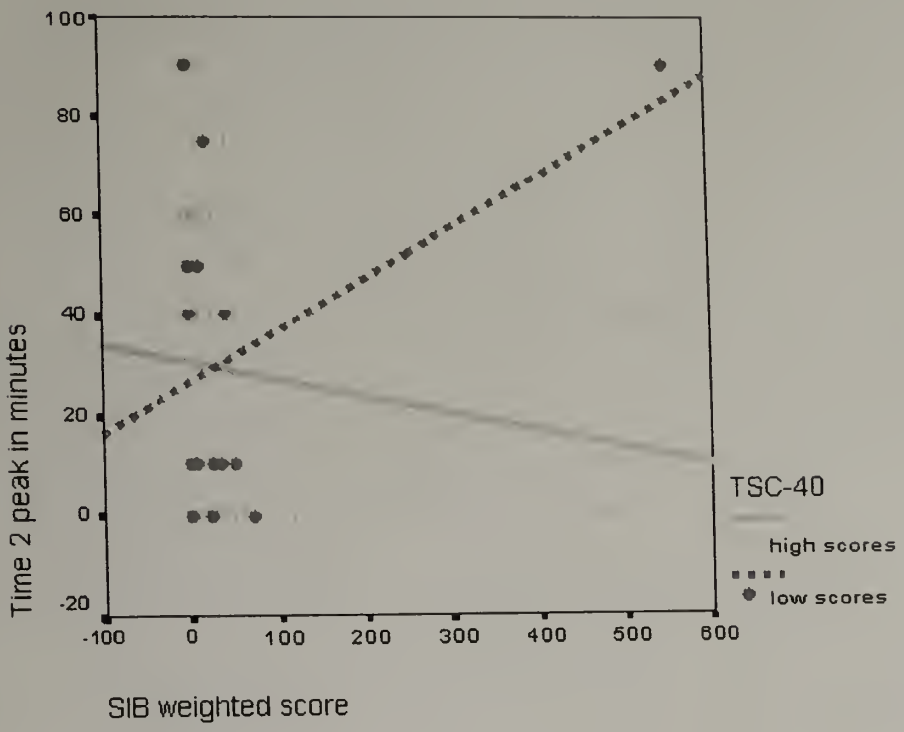


Figure 3. Women's trauma symptoms moderate the relation between self-injury scores and anticipatory cortisol level (ug/dl).

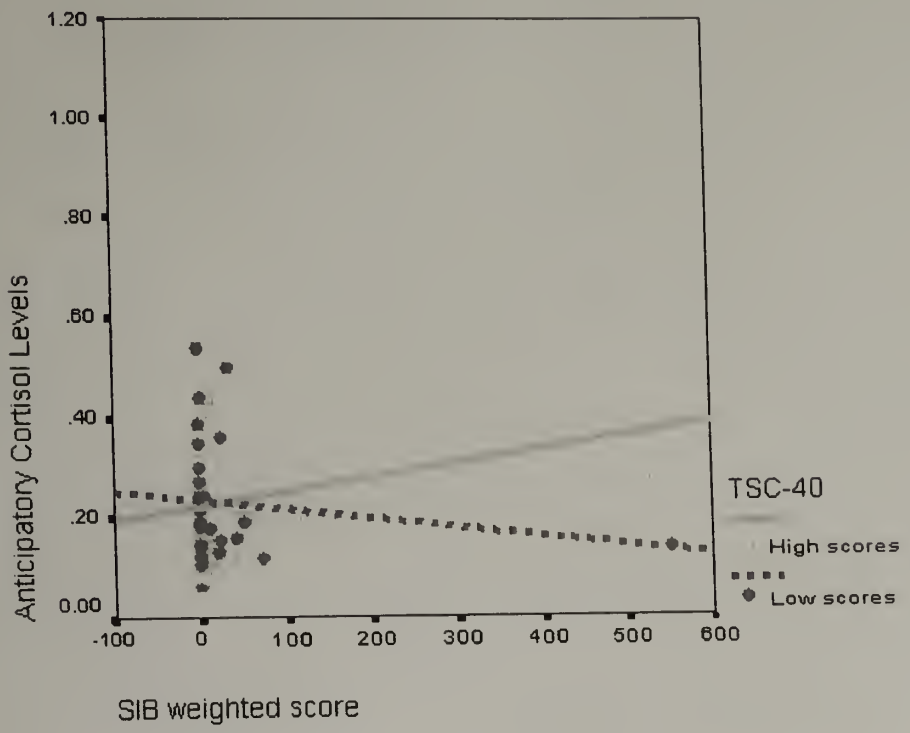


Figure 4. Women's depression symptoms moderate the relation between self-injury scores and basal cortisol levels (ug/dl).

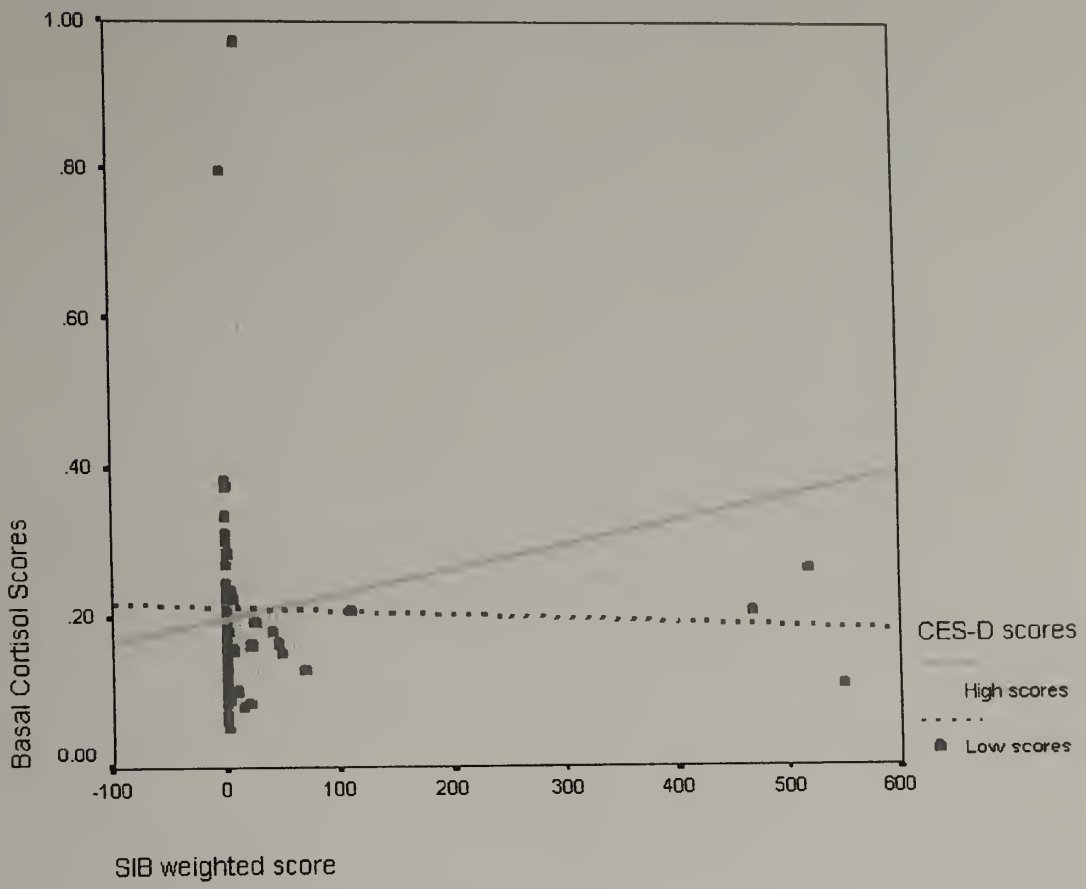
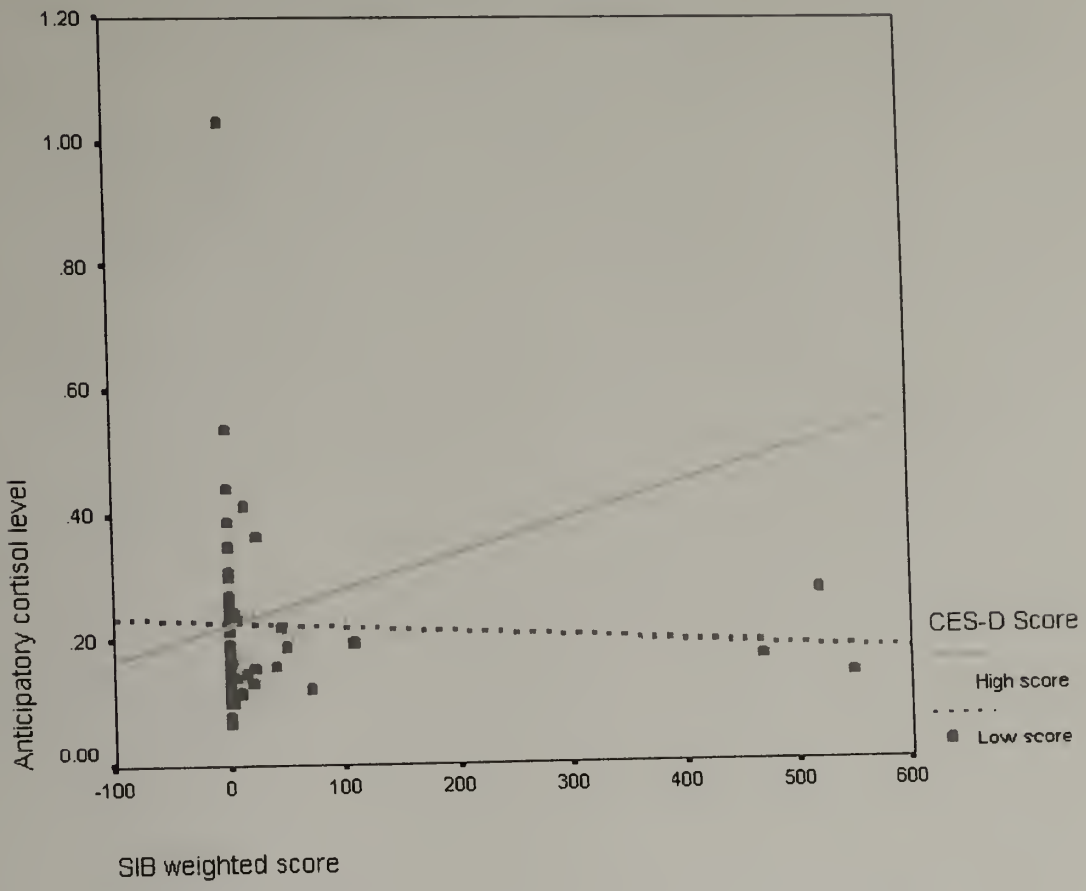


Figure 5. Women's depression symptoms moderate the relation between self-injury scores and anticipatory cortisol levels (ug/dl).



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